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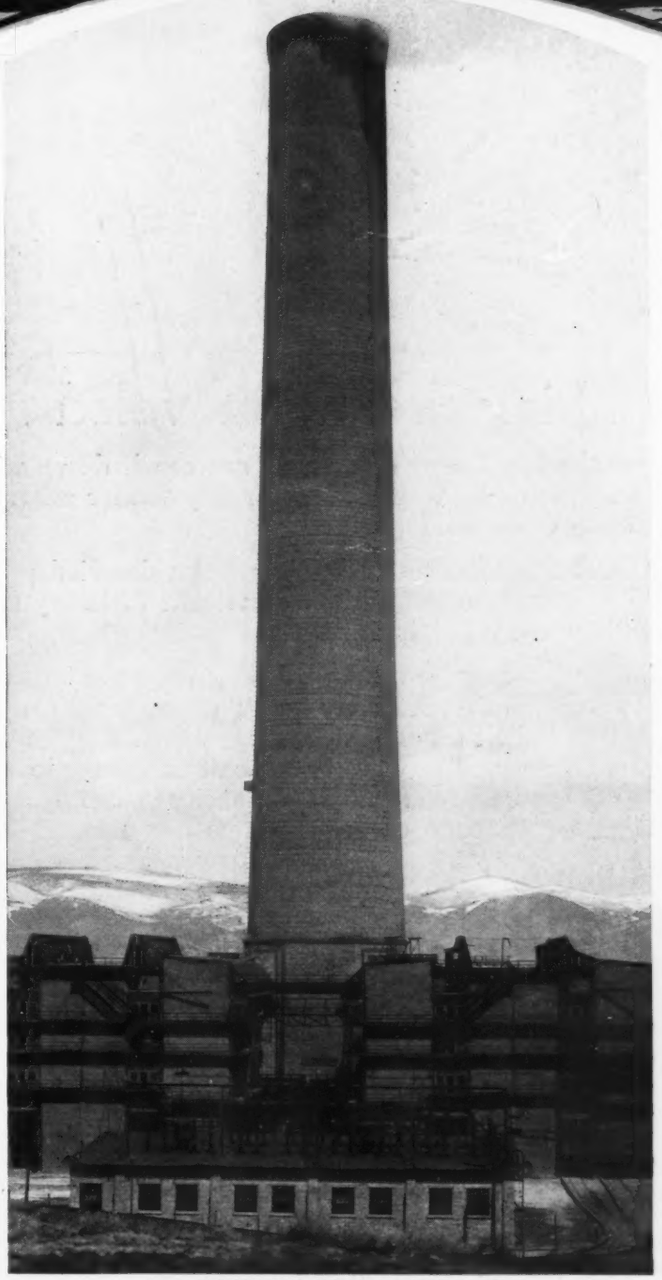

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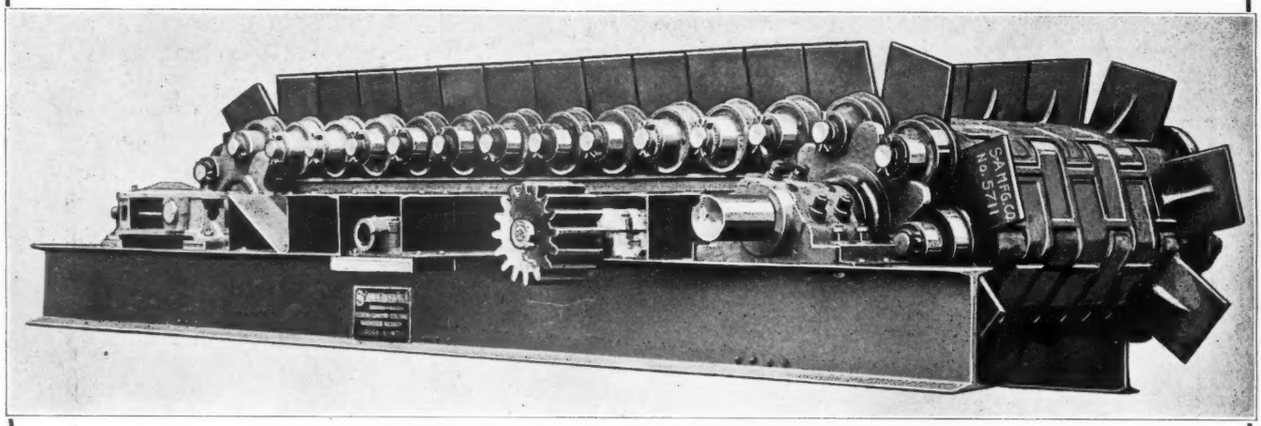

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"Boost, Don't Knock"

THE pleasant old-fashioned custom of certain great kings and emperors in the good old days was to behead messengers who brought bad news. The luckless wight (why are wights always luckless?) who brought the news of a battle lost was picked for sacrifice beforehand, and said his prayers to his heathen gods before he entered the august presence. Scarcely less cheerful is the reception, in this commercial country and age, of the man who sees trouble, who announces dull times and failures, the Gloomy Guses of the financial game. Especially is this true of mining. Most other businesses are frankly based on calculations: statistics and precedents are valued and eagerly consulted; economic laws are generally discussed, though with varying intelligence. The financial pages, the exports and imports, the European situation and the Asiatic situation and their effects on business are gravely and respectfully considered. The farmer also has respect for calculations and science, and bases his plans with due respect for entomology, meteorology and economics—that is to say, with due regard for bugs, weather, and markets. And even in mining this is true of those more or less astute groups who are gradually extending their control over larger areas of the metal and mining industries. They are controlled by business men; the enterprises are founded in finance, and based on marketing; and mining operations, which constitute the specialty of these groups, are considered hardly less conservatively than the banker considers his loans. Hence they move slowly and with exasperating caution: they are not popular: they examine and "turn down" a thousand prospects. But though powerful and growing, they are numerically the least of the mining fraternity.

At the other end of the line is found the group who are entranced with the joy and hope and gamble of what of riches may be hidden in the earth: the knights of the pick and burro: the drivers of year-long crosscuts and drifts. These have some knowledge; much hope; and a wonderful vision and faith. They are a kindly and gentle folk: and their philosophy and world outlook, bred of a thousand nights of meditation on the desert or in the forest, is by and large better than those of the shrewd financial judges at the other end of the mining line. And between the two ends of the line, close behind the financial, business, major mining group, come the mining engineers, characteristically appraising, calculating and cautious; and therefore also not altogether popular, though as a class much respected in mining regions for their hardiness and upstanding qualities. Then comes the "mining man," the enterpriser-promoter, varying in judgment and principle, with an eye open at once to intrinsic merit of properties and to milking the public, and yet with a modicum of visionary hope of splendid orebodies and great reduction plants. If he wins, the public has a chance to win grandly with him: if he loses, it will be in most cases the public which really loses, not he. In the midst of his great vision he is shrewd enough to have provided against such contingencies. The investing public has not; they have not provided, as he has, for a strategic retreat.

Just outside the line stand the camp-followers of the mining army—those who profit by money that goes into mining whether it is lost or not. They will profit most if it is not lost, for then more and more money will circulate around them. But in any case, some of the money that circulates, whether bound for success or for the bottomless hole of mining ventures, sticks to their fingers: so they are first, and last, simply for money being spent. They are the average citizen of mining towns and mining districts—store-keepers, real-estate men, functionaries and professional men of all grades. They can contemplate with equanimity the putting of two dollars into the ground to get out fifty cents: they believe in it. Why shouldn't they? To them, then, all mining country is a good gamble. They love a generous plunger, but they want others to fork out the money: if they themselves invest at all, it will be shrewdly. These are the greatest boomers of mining speculation, the boost-don't-knock people—they and the fly-by-night curb brokers of New York, San Francisco, *et al.* But they want George to do it.

With the exception of some of these camp followers and some of the promoters, the whole mining army is useful and an economically coherent organization and natural development. It would be difficult to say whether the shrewd business man and organizer, the engineer, the honestly sporting enterpriser or the prospector is the most useful. The omission of any one group would make the position of all the others impossible—they could not exist. Every man, then, who has his eye on real mines and prospects and pins his hopes on getting money out of the ground is an asset to the industry. But the man who hopes, posing as a mining booster, to get his money, not out of the ground, but slyly from the pockets of the public, which he picks while he is hurrahing for mining, is not an asset, but a poisonous evil and a disgrace to a noble industry.

Comment and Criticism, or Apathy

THE LAST BULLETIN of the Institution of Mining & Metallurgy contains, among other things, sixty-four pages of technical matter, all of which consists of discussion and amplification of papers previously presented, and of authors' replies to comments and criticisms. The subjects that have aroused the interest of our confreres across the Atlantic include topics such as "Clean Reef Mining and Its Influence on Mining Costs," "Treatment of Pyritic Concentrate Containing Tin," "Valuation of Ores, Concentrates and Smelting Products," "Mine Ventilation and Human Effi-

ciency," "Underground Working of Wide Pyritic Orebodies," "Re-establishment of the Gold Basis of Currency."

The interest displayed in these subjects by members of the Institution indicates that the original papers were timely and worth while. Published matter that invariably occasions neither comment nor criticism is likely to be insipid or too unreliable to merit attention by thoughtful engineers.

Secret Processes

"MANY a true word is spoken in jest," says the proverb; many a quack, in describing what to the skilled metallurgist appears to be a technical absurdity, unconsciously heralds an important discovery. In the *Engineering & Mining Journal* of Aug. 30, 1902—twenty years ago—readers were reminded that, "Secret processes which extract gold from unexpected sources or in unexpected quantities seem to have an unfailing attraction for miners as well as for the general public. . . . The last to make its appearance is the 'oil of gold,' reports concerning which come from Leadville, and which seems to have attracted the attention of some experienced mining men." What the "oil of gold" was we can only guess. The alleged inventor, the proprietor of a grocery store, stated that the metal was recovered "in an immature state." It may be that he removed pyrite from pulverized rock by means of oil, the amount of "fool's gold" thus obtained prompting him to make the assertion that he could recover "from low-grade ores, carrying merely a trace of the precious metals, five or six ounces of gold." However, only a few years later the practicability of recovering gold by means of oil was demonstrated, although the flotation process, as applied to either silver or gold ores, was not an economic success. Thus it behooves us to be wary of condemning the antics of charlatans; for their absurdities may presage a worthwhile invention.

Does the Consumer Appreciate the Purity of Electrolytic Metals?

THE ELECTROLYTIC PROCESS of purifying and producing metals is simple in principle and economical in operation, and has been adapted for the commercial production of many of them, but chiefly for copper, zinc, lead, and tin. Peculiarly enough, the introduction of electrolytic metals to manufacturers has usually been attended with difficulty in acquainting the consumer with the merits of the product. Electrolytic copper, for example, was considered by many consumers inferior to Lake copper, and today even some of them insist on receiving Lake copper in preference to electrolytic brands. Tin, one of the metals most recently produced commercially by the electrolytic process, despite its high purity, was declared by certain of the tin-plate manufacturers to be inferior to ordinary grades. However, education by the producers, coupled with practical tests by the consumers, has demonstrated the purity and usefulness of electrolytic non-ferrous metals, so that nowadays no discrimination against them is to be noted. In fact some electrolytic metals, because of their exceptional purity, command a higher price than the ordinary grades. Electrolytic zinc is an example. The common Prime Western brands of zinc used in the galvanizing trade are impure and command the lowest price of all of the virgin grades of zinc. On the other hand, the remarkable purity of electrolytic zinc makes it in demand by the brass and copper-zinc alloy manufacturers. It is rightfully sold for higher prices than Prime Western.

The largest American producer of electrolytic zinc—the Anaconda Copper Mining Co.—turns out its entire product electrolytically in a model highly efficient large plant at Great Falls, Mont. Its capacity amounts to 10,000,000 lb. per month, which, however, is too large at the present time, in conjunction with the production of high-grade zinc by other producers, to be absorbed completely by the brass industry. As a result, some of this electrolytic zinc must be sold as Prime Western, and to do so it is necessary to adulterate the high-grade zinc by the addition of lead. Galvanizers claim that the presence of lead in the zinc that they use is essential to the successful application of the metal on iron. Is this correct? Or is it a matter of education of the consumer to acquaint him with the advantage of using a high-grade product? We have an idea that a study of the use of zinc in its various forms, and the advisability of using the purer grades, would result in widening the demand for the higher class of metal. It would be interesting to learn from our readers their actual experience with the use of the higher-grade metals, whether copper, zinc, lead, or others, the prejudices encountered, and how they were overcome.

Seniority

APPARENTLY the obstacle to an immediate settlement of the railroad strike is the refusal of the railroad executives to restore seniority rights to those members of the shop unions that went on strike. The settlement would be based upon the acceptance by the employees of the wage reduction prescribed by the Railroad Labor Board; they are prepared to concede the essential point for which they were alleged to have gone out, and the only issue is one that could not have arisen if there had been no strike. The dispute concerning seniority was the consequence of the walk-out of some of the old employees; the sticking of some to their work; and the employment of new men to refill, as far as possible, the depleted ranks.

The reasons why this question of seniority is so important can be explained by describing the way the principle affects the blacksmithing and steel-sharpening organization of a large mining company that may be operating in a district where unionism is well established. Assume that the mine is a new one. For obvious reasons a blacksmith is one of the first men to be put to work. Let him be designated as A. He will have to have a helper, according to union rules, whether there is work enough for two men or not, but the helper belongs to a separate union classification and is involved in a chain of employees separate from, but similar to, that which we are about to describe. As the mine grows, more blacksmiths are required; in the course of a few years B and C and D and so on, let us say, up to M may be employed. But just as long as A wants to continue to work he has his job in preference to any of the others. Ordinarily he can arrange to lay-off when he desires to, and, if sick, he can demand a lay-off. He can come back when he gets ready, so long as he doesn't go to work as a blacksmith for any other company in the interim. By doing that he would automatically forfeit his seniority. The only grounds upon

which the company can discharge a man are gross incompetence or insubordination, and the union is virtually the judge of what constitutes incompetence or insubordination in any individual case, because if an employee is discharged he may, if he desires, appeal to the local union and if the members decide that he has been unfairly treated reinstatement may be demanded. The club with which such demand is enforced is the strike; threats by the union are often sufficient, but more than one serious strike had been caused by this very thing.

Suppose that the company curtails operations and must reduce the force in the blacksmith shop. M must be laid off first, then L, then K and so on back to A. If laid off, the men are free to accept jobs elsewhere, but when the company rebuilds its force the re-hiring must be done in rotation, beginning with A. Obviously, this system makes it impossible for the company to select more competent or more desirable men or to get rid of the less valuable man unless gross incompetence can be established. Obviously, also, there is a decided advantage to the employee in being among those at the top of the seniority list.

Suppose a strike is called. Assume that A, B and C are radical agitators and are strongly in favor of the strike, whereas D and E believe the strike unjustified and decide to remain at work. New men, probably nonunion, are obtained in the effort to assure a full complement in the shop and permit the miners who are not involved in the strike to continue production. The strikers are notified that their seniority rights will be forfeited if they do not return within a prescribed time; if they fail to do so D takes the place of A, and E the place of B, the newly employed men assuming consecutive places according to the order in which they are employed.

Generally, however, it has been the practice to stipulate as one of the conditions of ending the strike that full seniority rights will be restored; that means that D and E, who remained at work, will be demoted, so to speak, and the new men will be turned out into the cold. This procedure has, of course, been a powerful weapon in the hands of the strikers. Knowing the probable terms of settlement, the mine superintendent could not promise a new man a permanent job if he would come to work. His status was virtually that of a strike breaker instead of a man who wanted steady employment and was satisfied with the working conditions and the wages offered. Instead of being prepared to offer a man like D the inducement of advance to the favored place of A, the mine superintendent was deterred by the knowledge that in the end A would come back and resume the status that he held when he deserted. No matter how active he had been in breeding discontent and dissatisfaction among the other men, A would return to renew his agitation when the occasion arose. The superintendent was helpless.

But the most important phase of the problem from the union standpoint is this: If, at the conclusion of the strike the men who replaced the strikers are retained, they must be taken into the union. Why? Simply because otherwise the "job" automatically becomes "open shop," and as between the two evils, the union would doubtless admit to membership the men whom as strike breakers it despises from the bottom of its organized heart, rather than surrender the one tenet from which unionism derives its vigor: the closed shop. It is for this reason that heretofore one provision of a strike settlement almost invariably has been the restoration without prejudice of all seniority rights.

Under all conditions the principle of seniority is undesirable from the standpoint of the company. To the extent that it relieves the working man from the fear that he may be discharged unexpectedly because of the whim of some foreman, it may be defensible. We do not understand that the railroad executives desire to abolish the principle of seniority; what they do insist is that the strikers in the present controversy who desire to return, start at the bottom of the seniority ladder. Clearly from the union point of view they demand much.

Military Protection of Mining Companies in Mexico

ONE OF THE MOST DISTRESSING results of the series of revolutions in Mexico that have simmered or come to a head since the resignation of Porfirio Diaz has been in regard to the uncertainty of continuing operation in isolated districts, where the community was at the mercy of gangs of bandits that roamed the hillsides in search of an excuse for the use of their rifles. Mining companies whose financial resources were insufficient to meet abnormal demands for protection had to go out of business. Others who could evade bankruptcy were mulcted in considerable sums for military protection, often of such a character that the armed guards supplied by the government were begged to withdraw, the pecadillos of the bandits being preferred to the delinquencies of the paid emissaries of the state.

The Amparo Mining Co. operates at Etzatlan, in the State of Jalisco, and it is interesting to note that the general expense involved by the need for military protection has shown a steady decrease during recent years. In 1919 it was $25,460.17; in 1920, $20,808.60; and in 1921, $18,811.77. Conditions in the distressful country to the south of us are improving slowly, and foreign enterprise is to be congratulated on the patience and forbearance with which it has viewed the almost imperceptible movement toward normal conditions. It is a farce that American enterprise abroad need spend large sums on military protection to enable it to develop foreign industries. In time, let us hope, reason will prevail, and mining will then flourish in Mexico as it did of old.

A Plea for Credit

A NORTH BAY, Ontario, paper, the *Daily Nugget*, republished on July 12 our biography of D. C. Jackling which appeared in the *Journal-Press* of July 8. The article was published word for word. We value the compliment paid us by its publication: but no reference was made to the source of the article. Our articles are all original and all represent a great deal of labor and preparation. It is only courteous that those who profit by the opportunity of using our material second hand should acknowledge the source.

We understand that a great map-publishing firm recently sued a great book-publishing firm for infringement of copyright, the latter having made use of an outline map of the United States, published by the former, as a basis for a diagram. We are not punctilious to that degree: we are glad to have our articles copied into other journals, but with the customary ceremonies.

Mining in the Kootenay

By T. A. Rickard

THIS MINING REGION in British Columbia is divided into the East Kootenay, with an area of 16,330 square miles, and the West Kootenay, with an area of 13.638 square miles, out of the 372,630 square miles covered by the whole of the Province of British Columbia. The West Kootenay embraces several well-known Mining Divisions, as they are named officially, including Nelson, Ainsworth, Slocan, and Trail Creek (Rossland). The East Kootenay includes the Fort Steele division, in which is situated one of the great mines of the world, the Sullivan, and one of the great coalfields of the world, the Crow's Nest, which lies on the western flank of the main range of the Rocky Mountains. Both the Kootenays, as they are called by the miners, are on the Columbia watershed, that noble river flowing north through the East Kootenay and returning south, after making the Big Bend, through the nearly parallel territory of the West Kootenay. The region as a whole is mountainous and forest-clad; it is traversed by magnificent rivers, many of which occupy long glaciated valleys in which they become widened to lovely lakes, well known to tourists.

Nelson, a charming little town on the west arm of Lake Kootenay, is the main point of departure for mining exploration in this part of the world. Just now mining activity in the immediate vicinity of the town is considerably less than it was twenty years ago, but signs of revival are discernible. The Nugget mine, on Sheep creek, is producing 80 tons of $8 gold ore daily. This is treated in a mill of ten heavy stamps. The property includes the old Mother Lode mine and is owned in Vancouver. A scheme is afoot to consolidate these mines with the Fawn, Queen, and Kootenay Belle. Near-by is the Reno, on Fawn creek. Here some rich ore has been struck recently. The controlling owner is W. P. Poole, of Spokane. The Bayonne group of claims is being operated by John B. White, of Spokane. Good ore, 2½ ft. wide and assaying $35 per ton in gold, is reported to have been struck in the sulphide zone at 500 ft. The Iva Fern, on Cultos creek, which was located by John W. Mulholland in 1914, has been re-opened successfully and is now under bond to the Standard Silver Lead Co., of Spokane. Jack Mulholland is one of the best known prospectors in British Columbia; he was in bad luck until he 'struck it' in the Iva Fern this year, and his success has been greeted with acclaim. On a recent trip he met a grizzly bear and killed it after a big fight. In the Ainsworth district, the Florence has just resumed operations with 50 men, under the management of F. R. Wolfle. It produces a silver-lead ore almost free from zinc. The mill has a capacity of 200 tons daily and is equipped with a flotation plant. There is said to be plenty of ore in this mine, but it is not in shape yet to maintain a steady output. At Kaslo, the Utica mine is a producer of high-grade silver-lead ore on a small scale, as also is the Cork-Province, which is now undergoing development in the hope of supplying ore to its 150-ton mill. Many small parties of lessees are at work on other mines in the district, which overlooks Lake Kootenay. On the opposite shore, at Riondel, is the old Blue Bell mine, which was discovered in 1867 and was the scene of a fatal fight between the two locators. The property has been owned for many years by a French company, for whom S. S. Fowler is resident manager. The lode, which yields a silver-lead ore, is a replacement in limestone and continues healthy to a depth of 600 ft. The mill has a daily capacity of 200 tons. The company's affairs are being reorganized with a view to a resumption of operations.

In the Slocan a number of small operations are under way, besides the Silversmith, which is a richly productive mine. It was known formerly as the Slocan Star and is controlled in Spokane. Eighty men are employed. A 100-ton mill, with a flotation annex, is treating the silver-lead ore. At Sandon also the Noble Five, which belongs to the Dunsmuir Estate, has been examined recently by Mr. Fowler, with a view to a possible resumption of activity. The property has a large mill and is well equipped, the sum of $800,000 having been spent on it. The Bosun, on Slocan Lake, employs 30 men. A hand-sorted product of silver-lead ore is shipped to the smelter at Trail.

The Sullivan mine, at Kimberley, in the East Kootenay, is owned by the Consolidated Mining & Smelting Company of Canada, which is identified with the large and well-equipped smelter at Trail. This mine has enormous reserves of a complex silver-lead-zinc ore, the estimates of tonnage being well above 25,000,000. In 1920 this mine yielded 25,000,000 lb. of lead and 40,000,000 lb. of zinc. The property was owned formerly by the Federal Mining & Smelting Co., from whom a lease and bond was obtained for the Consolidated Company, by R. H. Stewart, then manager, in 1909. It has been opened up in recent years under S. G. Blaylock, who is now general manager for the Consolidated. E. C. Montgomery is superintendent of the mine, which, as I have said, is one of the new great mines of the world. The working force consists of 550 men. Up to the present the ore has been concentrated in a 1000-ton mill at the smelter, but now a new 1500-ton mill, with an expected working capacity of 2000 tons, is being built near the mine itself, after an exhaustive series of experimental investigation. The ore is crushed to half-inch and is then ground to 200-mesh in ball-mills before flotation in an alkaline solution. Crude soda-ash is used. Differential flotation is facilitated by the aid of copper sulphate. Thus a lead concentrate containing 55% lead and 8 to 9 oz. silver per ton is produced, as well as a zinc concentrate assaying 38% zinc and 12% lead.

The successful reduction of zinc ores at Trail has enabled the Consolidated Company to grant more favorable rates to its customers. Formerly any zinc in a silver-lead ore was penalized at the rate of 60 cents per unit; now the penalty is only 30 cents per unit. One reason is the ability to put more zinc into the lead-furnace slag, but the principal favorable factor is the ability to treat ores high in zinc, and to extract the zinc profitably, so that it has ceased to be a metallurgical nuisance. It is pleasant to note that the Consolidated Mining and Smelting Company has won the good-will of the mining community in the Kootenay and that there are evident signs of cordial co-operation between the mine operators and staff at the smelter.

DISCUSSION

Revision of the Mining Law

From a Woman Prospector

THE EDITOR:

Sir—I wish to protest against Mr. Winchell's statement that all the good mines have been found.

The ranges of the Mother Lode of California are so covered with chapparal that one can see only a few feet ahead, and no doubt many undiscovered ledges are hidden there. From high peaks view the vast ranges of Nevada, consider the time necessary to examine and assay the many ledges exposed, and ask yourself if the puny efforts of man have discovered all their secrets. New finds are continually made on ground looked over for sixty years.

"Many there be that have eyes but they see not" is still a truth. One of those men sent here to comb this section for a large company spent the summer with me. He was fat, had been snow blind in Alaska, and could not see twenty feet away. He killed three months' time lying in the hammock reading the latest magazines, enjoying fried chicken, hot biscuits, and buttermilk. He made about three short trips to the canyons where the fishing was good, drew $500 pay, and reported nothing found. Two years later he committed suicide; perhaps his conscience hurt him.

The prospector with the burro has gone, but a new and better informed man with the Ford has taken his place, but he must work three months in the hay field to get money to live through the winter, and during spring and fall prospecting.

We do not need a new mining law. What we need is a bill to subsidize the prospector with bacon, beans, overalls, and tobacco. This would remove the necessity for Bill Jones and Sam Smith to swap location notices to hold their claims. They would have time to find something for the subsidized ships to carry.

Yerington, Nev. A WOMAN PROSPECTOR.

Finding a Mine

THE EDITOR:

Sir—In the *Journal-Press* of July 22 there appears a very interesting letter from Mr. L. S. Ropes, entitled "Revision of the Mining Law." In discussing Mr. Winchell's testimony before the Mines and Mining Committee, the author strays from the subject of his letter, but in so doing brings up another matter of extreme interest to the mining industry in general and to the owners of mining prospects in particular. We might call this side issue of Mr. Ropes', "Finding a Mine."

Mr. Winchell testified that he knew of "twenty exploration companies who have raked this country north, south, east, and west, from Alaska to the Rio Grande . . . . . but have been unable to find anything". Now, what is the cause of this? Have all the valuable ore deposits been found? Will the exhaustion of our known mines, a few decades hence, mean the end of the mineral industry in this country? I say, most emphatically, No!

The cause of the failure of the twenty exploration companies lies in the methods they employ to find mines and, to some extent, in some cases probably to a large extent, to inexperience, fear, or undue haste on the part of the "scout engineers" they send out.

To examine all the prospects or, as Mr. Winchell says, "to examine everything and anything anybody could put up to them," from Alaska to the Rio Grande would take a small army of engineers a lifetime. To expect one engineer or a dozen engineers to accomplish this in a year or two of traveling is an absurdity. One engineer, devoting all of his attention for six months to a single mining district, would be a hundred times more likely to find a mine for his clients than a dozen engineers hastily squinting at all the prospects on the western side of the continent.

We are not going to find our future mines boldly outcropping at the surface, at least not in the regions where a Ford can travel, nor are we likely to stumble over them while trying to round up our burros. The prospector, or what there is left of him, is no longer coming to us with a tale of how he has sunk his shaft 100 ft. deep in "solid sand carbonate with no walls showing." We have all got to be mining geologists and we have got to find our future mines by solving geological problems. We must be able to recognize the features that are responsible for ore, the formations in which the ore occurs, the effect of faulting, fracturing, folding, erosion, and igneous intrusions, and, if any ore is visible, its source, its mode of deposition, its probable changes in depth, and other pertinent facts. This takes time, and no engineer, no matter how clever he may be, can render a fair report on a discovery or prospect until he has studied the geological conditions affecting it.

There are prospects in this country today which, from a geological standpoint, bear every indication of becoming valuable mines, but do the scout engineers take the time to investigate these opportunities? No; they are instructed to visit a certain number of places in a certain amount of time, so all they can do is to give such prospects the "once over," look around for ore that they can sample and measure, and, not finding any, move on to the next place.

Were such mines as the Chief Consolidated, Tintic, Standard, and now the Park-Utah found by engineers sent out by the exploration companies? No; they are the result of months and months of hard, conscientious work devoted to those respective properties by engineers and geologists, backed up financially by men who had confidence in them.

It seems strange that exploration companies, financed by men who have been successful in other lines of business, should be willing to engage inexperienced engineers just out of school, often with no more field work to their credit than surveying or mine sampling, to pass judgment on a prospect; but they do it, nevertheless. We do not blame the engineer; neither do we wonder why the exploration companies fail.

The principal weakness or deficiency on the part of the engineer is fear—fear that if he recommends a prospect and it subsequently turns out to be a failure his reputation will be impaired. This is a mistaken idea which may result in a loss to his company of a valuable property. One successful property will often make up for the losses incurred in prospecting many valueless ones. Not long ago a young engineer of one of the large exploration companies boasted to me that he had been traveling from Alaska to Mexico, looking for mines, and had turned down every mine and prospect he had examined. He said that he always entered a mine a pessimist, his mind fully made up to turn the property down before he had seen it. If there are others like him—and I have no doubt there are—is it any wonder that the exploration companies are unsuccessful?

Send the engineer to a mineralized district. Give him all the times he needs, six months if necessary, to familiarize himself thoroughly with the general geology of that district. When this has been done, he will be properly equipped to judge the merits of any properties that are offered in that district. Let him use the diamond drill if he thinks it advisable, and the chances are ten to one in his favor that he will find a mine in less time and at less cost than the dozen or so engineers that are spending the company's funds in railroad fare, steamship tickets, and jitney hire between the Bering Strait and the Rio Grande. F. M. WICHMAN.

Salt Lake City, Utah.

The Prospector Rises to Explain

THE EDITOR:

Sir—A word to the reader so he will be put straight on the life of a prospector. These men are not born with a miner's brain; they are a product of the system, their ambition is to get off the labor market. Take my case—I started out as a preacher, and I had the largest dinner bell on my meeting house that there was in the territory. I rang my dinner bell three times regularly every Sunday, and with all my efforts I could not get my pork chops, so I called a meeting of my followers and let the fact be known that they would have to dig up if they wanted me to stay on the job. They told me they were all broke, all they had was mining stocks which were not worth a cent. Right here I discovered I was on the wrong end of the pay streak, so I took the rope off the dinner bell for a windlass and started out to look for a mine.

Before I take the reader into the mining field, I will call his attention to an old saying here in Arizona that any person that has ever drank out of the Hassayampa River will always sleep with his head down hill and will never tell the truth again. I had prospected on this river. I wanted to land on the pay streak as soon as possible and, knowing that mining and prospecting date back to old King Solomon's time, I was satisfied that there were great wagon loads of information on this said gold parked in these mining engineer's heads. So I proceeded to interview them by the hundred, trying to find an explanation as to the whys and hows this gold found its way to the placer field. None of them could give me a straight steer, so I asked an old Mexican dry-washer miner what he knew. He told me that when old St. Peter left the earth he gathered all the gold and packed it on a white burro and was going to take it with him. He traveled across the sky afoot with his burro, and the trail he left behind was the Milky Way; but his burro got tired at several times and old Peter had to cut the sack and let some of the gold run out to lighten the load, and if I could locate where the burro got tired I could find the gold on this earth. That is one reason you will always find me under the Milky Way.

Right here I will ask the reader—is it any wonder the prospector has brain storms at times when he has to sleep with his head down hill? E. B. FOSTER.

Kingman, Ariz.

The Wolf Mineral Process Suits

THE EDITOR:

Sir—The article in the July 22 issue, containing in substance the answer of Minerals Separation to the Wolf Mineral Process suits, is, as it purports, a presentation of the Minerals Separation's answer, and, regarded in this light, it has evidently been carefully prepared and seems fairly to present their view. There is one statement, however, at the end of the first paragraph, which says: "In this suit Wolf set up as a counter claim the charges that his assignee repeats in the pending suit." An accurate reading of the answer of Minerals Separation will show you that they do not make that charge, which indeed could not be made.

We have been unable to obtain a record of the London suit, but in accordance with the decision acknowledged by the defendant, the following facts seem clear: First, the suit referred to as between Sulman & Picard and Wolf had no reference to patent No. 835,120, and Wolf made no claim for that patent. Indeed it was not issued at that time, nor did Wolf know of it. It is, therefore, not correct, either as a statement of fact or as a statement of their position, that the charges made in the present suit have ever been made before in any suit.

New York, N. Y. WILLIS B. RICE,
Duell, Warfield & Duell.

Factors Influencing Value of Oil-Shale Lands

THE EDITOR:

Sir—In your issue of July 8, Mr. Dean E. Winchester, in his article on "Factors Influencing Value of Oil-Shale Lands," exhausts most of the alphabetical letters in outlining these "factors."

Will you kindly give a dub (who has struggled with this shale problem for some years), space to submit the six real hard-boiled factors which confront the producer of shale oil today? They are: (1) Cash on hand; (2) stratum of shale at least 10 ft. thick, free from overburden, and having a minimum content of 42 gal. oil to the ton; (3) minimum cost of mining, crushing, and putting into bins of 50c. per ton; (4) water near by; (5) proper retorting process; and (6) more cash.

The leading Scotch processes are designed to recover ammonia as a main product, and oil as a byproduct; whereas in this country, plants must be designed to recover oil as a main product, and, as Colorado and Utah shales have an average of but 14 lb. ammonia, that item may be neglected in reckoning shale values, as "that ain't nothin' to it nohow."

In 1920, I submitted to Mr. H. C. Goodrich, chief engineer of the Utah Copper Co., a full description of a stratum of shale on White River, Rio Blanco County, Col., and asked him to give me an estimate of mining costs, and this was his reply:

"With an installation to handle 2,500 tons per day, which would have to stand the overhead expense for that particular tonnage, where it is economically and efficiently handled, I would judge that the cost of moving the material and crushing same to 1½ mesh would not exceed 65c. per yard."

After eight months' continuous operation of a Wallace retort in New Brunswick last year, we know definitely that shale treated in a properly constructed, commercial-size retort of the Wallace type will yield more oil and of a better quality than can be turned out in the laboratory.

With a plant of 2,500 tons' daily capacity, working under conditions as outlined in the above, crude shale oil can be produced at less than $1 per bbl., but when shale has to be mined underground, another dollar must be added to cover cost of extraction.

Transportation will always find its way to settled production of any desirable commodity such as coal and oil. I know of no payable oil shale beds on the main line of any railroad either in Utah or Colorado. In conclusion, I should like to ask if California, Wyoming, or Mid-Continental fields are producing petroleum from wells at anything like $1 per bbl.? HECTOR MCRAE.

St. Louis, Mo.

A Peripatetic Institute Council

THE EDITOR:

Sir—In a recent issue you mention the suggestion for holding meetings of the directors of the A. I. M. E. at the larger cities of the country instead of holding them all at headquarters in New York. It is supposed that such a geographic distribution of board meetings would enable directors not living in New York or near that city to attend the meetings, thereby making them more representative in character; also it is suggested that the presence of the directors in a city would be a pleasant excuse for calling a meeting of the local section, and thereby promoting the acquaintance of members with the directors.

This is a charming idea, but it seems to me unlikely to fulfil its avowed purposes. In the first place, if a meeting of directors were held at Spokane, for example, it is most unlikely that the personnel of the meeting would be the same as that of the previous meeting at another distant city, let us say, St. Louis. At present the directors' meetings fail to be representative because directors living at a distance fail to attend them, in consequence of which the business is transacted by the half-dozen directors that do attend regularly. Thus, in effect, six men exercise the control supposed to be distributed among twenty-four. If the meeting were held at Spokane, it is probable that six would be on hand there as at New York, but it would be a different six. Imagine conducting the business of a board of directors under such conditions! There would be no continuity of policy.

The difficulty is purely geographic. So long as headquarters are at one side of the continent, it is going to be difficult to obtain a representative management of Institute affairs. To select a Western man as President one year and an Eastern man another year is a futile scheme, because, after all, the president of the Institute is in office much too short a time to be more than a figurehead. He needs half the term of office to find his bearings, and if he is modest and sagacious he will be slow to make any change of policy during the remaining months of his incumbency. The keyman, of course, is the Secretary; he is the permanent executive, and on the choice of an efficient secretary each one of the institutes depends for its welfare. Behind him is the small group of directors willing and able, by reason of residence near headquarters and the possession of leisure from personal affairs, to attend to the business of the Institute.

There was a time when mining and metallurgical engineers either lived in the East or went thither periodically. When the Institute was started, the mining business of the country centered in New York and Boston. Conditions have changed, but the geography of the United States remains the same. This fact, I suggest, should be recognized by selecting a city nearer the center of the country as our headquarters. Denver would be suitable, not because it is, or was, a mining center, but because it is a focal point in railroad transportation. If the Institute had its head office at such a convenient point as Denver, it would be practicable to obtain a representative attendance of directors and to facilitate the accomplishment of the purposes for which the Institute was founded. Perhaps, Mr. Editor, your readers will express themselves on the subject in your columns; the question is of practicable importance and deserves frank discussion.

I am aware, of course, that the Institute has ties with the Engineering Societies building, and that, I presume, would be a serious, but not insurmountable, obstacle to a change of headquarters.

San Francisco, Cal. T. A. RICKARD.

Make It of Copper

THE EDITOR:

Sir—In connection with your "make-it-of-copper" campaign, and your recent editorial on copper radiators, allow me to relate a personal experience which is not without a certain tang.

Last February the 30-gal. galvanized-iron hot-water tank attached to my furnace burst and made a mess in my cellar. I had to replace it and set about to buy a new one. The price, I found by telephone enquiry, was $13.25. That very day I read one of your campaign articles and I decided to "make it of copper," if I could manage it. I turned up your metal quotations for that week and found that "electrolytic copper, N. Y., net refinery" was 13¼c. I estimated the weight of the tank at 60 lb., made a multiplication accordingly, and concluded, in my artlessness and inexperience, that a copper tank should cost about $7.95 more than a galvanized iron one, disregarding the cost of the material of the latter. I rang up my plumber's supplies man again. "Yes, he had the 30-gal. copper tanks. Rather more expensive though. Kindly hold the line, I'll see what I can do." (Pause). "Hallo, $67.50." I put in another galvanized-iron tank. THÉO. C. DENIS.

Quebec, Canada.

The Coolbaugh Process

THE EDITOR:

Sir—In Mr. Rickard's article 'Mining in Colorado' in the July 1 issue, I notice that he mentions my name as the inventor of a sulphate-roasting process. Mr. J. Burns Read and Mr. O. A. Fischer have been intimately associated with me in the origination and development of the ideas of this sulphate-roasting, and their names should also appear as originators of our process.

Denver, Col. M. F. COOLBAUGH.

Mining Engineers of Note

EDGAR P. RATHBONE

MOST LAYMEN get their notion of a mining engineer from perusing fiction written by imaginative persons whose hazy information regarding the species is largely hearsay. According to the popular idea the mining engineer is a two-fisted (he must have two fists) chap who is engaged in wresting endless wealth from the "treasure vaults of mother earth." The mining of virgin gold is most romantic, but silver and even vulgar copper find occasional favor among enterprising authors. The life of a proper mining engineer should be a kaleidoscopic series of adventures as he moves from one remote place to another on the fringe of civilization, with intermittent visits to New York or London to spend some of his money. Unfortunately, few successful engineers live up to the advance notices of fiction; but occasionally one rises above the commonplace and approaches them. Peruse, if you please, the following chronological sketch of the career of Edgar P. Rathbone, of London: Ushered into the world at Liverpool in 1856, young Rathbone received a practical education in mining while serving as an "articled pupil" to the late Emerson Bainbridge, manager of sundry coal-mining enterprises. Incidentally, he participated in the rescue work at the time of the great explosion at Swaithe Main, near Barnsley, when 130 men were killed. This experience had the effect of damping his enthusiasm for coal mining. He became a student at the Royal School of Mines in 1877; he studied later at Freiberg, and finished his schooling at the University of Liège. From Belgium he went to London, where he opened an office as consulting engineer in the firm of Bainbridge, Seymour & Rathbone, otherwise Brandy, Soda & Repentence, as the partners were styled by their intimates. The plans for the founding of the Institution of Mining & Metallurgy were made at meetings held in their office. Mr. Rathbone did the foreign work for the firm, and in a single year traveled more than 25,000 miles in making examinations in the southern part of the United States, in Mexico, and in Bolivia. Two thousand of these miles were covered astride the back of sundry patient burros.

EDGAR P. RATHBONE

After a series of negotiations with bloodthirsty brigands in Mexico—the fact that his subsequent career remains to be reviewed indicates that the negotiations were reasonably successful—he went to the Rand gold fields, in South Africa, in 1889. Here he established the *South African Mining & Engineering Journal.* As the first government inspector of mines Mr. Rathbone found himself in what he naïvely describes as an "untenable" position at the time of the Jameson Raid; accordingly he retired from the country. In his retreat he was more fortunate than John Hays Hammond, who was captured, condemned to death, and finally let off with a fine of £10,000. He deems himself particularly fortunate, because he knows of no one who could and would have paid a ransom on the Rathbone head. On returning to London he undertook a "roving tour" of the world's mining districts in behalf of a syndicate of South African capitalists. This was the year of the Klondike rush, and Mr. Rathbone visited almost every mining district in Canada from the Arctic Circle to the United States boundary. There followed another professional journey to the United States and later to various mines in Hungary, Rumania, and Italy. Our "biographee" was saved from becoming disgustingly wealthy by the failure of Dame Nature to enrich sufficiently the South African gold reefs on the opposite side of the basin from Johannesburg. For the South African Syndicate he acquired options on "farms" traversed by several miles of reefs which he had identified as being the same as those that were being so successfully exploited. He says that his geological conclusions proved to be absolutely correct; the fly in the ointment was the low gold content of the reef.

During the World War, Mr. Rathbone did his bit by serving in the C. I. D. and as a member of the Headquarters Special Constabulary. His son, Basil Rathbone, is on the stage in New York. The elder Rathbone confesses that he has now resigned himself to living in the reflected glory of a Broadway star, although he insists that he is still a young man at sixty-six.

Testing Rock Drills

Method Employed by Manufacturers to Determine Drilling Speed, Air Consumption, Blows Per Minute, Force of Blow, Wearing Quality, and Operation in General—Object to Insure Satisfactory Work in Field

By Royal J. Day

FACTORY TESTS of rock drills are generally made to determine six important points in the design of the machines, These points are: (1) The drilling speed, or the rate at which holes of a given size can be drilled in the rock upon which the machine is being tested; (2) the air consumption of the machine, which is generally referred to as the cubic feet of free air used per minute; (3) the number of blows delivered per minute by the piston (or hammer) of the machine; (4) the force of the blow delivered by the piston (or hammer); (5) the wearing quality of the materials used; and (6) the operation of the machine in general.

These six points are all given considerable attention during the development of the machine, but when the drill has passed the experimental stage and is being produced in the factory, the testing is somewhat simplified by the method of testing the individual parts before they are finally assembled as a complete unit. However, the complete drill is tested for drilling speed and must come up to set standards before it is passed by the inspector.

Machines have been developed for use in testing rock drills to determine the force of the blow delivered by the piston (or hammer), and also the number of blows struck per minute. It is, however, customary to test the drills under actual drilling conditions to determine the speed of drilling with various sizes of bits.

Drilling Speed Determined

Fig. 1 shows a representation of a typical set-up to determine the drilling speed of a rock drill. *A* is a block of rock. Care is exercised in selecting these test blocks so as to secure as uniform a specimen as possible, in regard to evenness of grain and freedom from soft spots and crevices. *B* is a vertical column which is attached to a heavy cast-iron base to give rigidity. The usual column arm and saddle is mounted upon the vertical column. The rock drill to be tested is shown at *C* and is clamped in the drill saddle in the regular manner.

It is customary to test the machines by using bits of various sizes, those most generally used being 1⅞-, 1¾- and 1⅝-in. diameter. After the machine has been set up as shown in Fig. 1, the method of procedure is as follows: The drill steel having the largest diameter bit is properly inserted in the chuck of the machine and the hole spotted on the rock. (Spotting the hole consists of running the drill slowly to remove any projection directly under the cutting edge of the bit, thereby producing a flat spot on the rock.) The full power is then turned into the machine, and the drill allowed to remain in operation for one minute, care being exercised in the timing so as to obtain the results for a run of as near one minute of operation as possible. At the end of this run the drill steel is removed from the machine, and the actual depth of the drilled hole is measured to the nearest ¼th of an inch, and a record made of the depth drilled.

The drill steel having the next smaller diameter bit is then properly inserted in the operating position and the drill is again run for one minute, and the amount drilled recorded. This is obtained by measuring the depth of the hole and deducting the amount previously drilled. The same procedure is carried on with the next smaller bit; that is, the drill steel is properly inserted in the operating position and the drill run for one minute, and the amount drilled determined and recorded.

It is customary to make several tests as described, so that an average may be obtained which is used in making efficiency charts showing the work performed.

Rock drills are generally operated on various pressures, ranging from 60 lb. per sq.in. or less, to 100 lb. per sq.in. or over. For this reason tests are run at various pressures, customarily 60, 70, 80, 90, and 100 lb. per sq.in. From the recorded results of these tests a curve can be plotted (which will be described later), showing the approximate drilling speed that may be expected from the drill at a given air pressure.

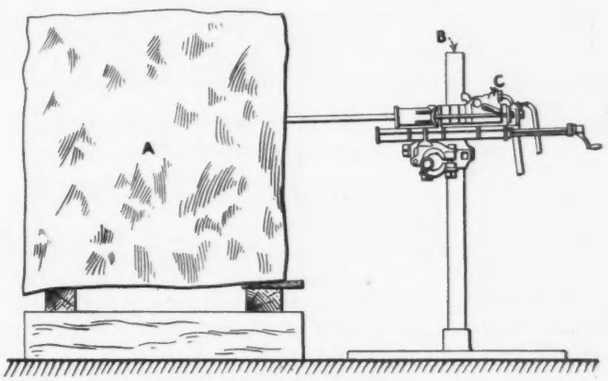


Fig. 1—Set-up of rock drill for testing to determine drilling speed

Determining Air Consumption

Meters of various types have been designed which show the amount of air that is passing through the machine being tested, generally in cubic feet of free air per minute. What is desired in connection with the test previously outlined is the actual amount of free air used by the machine for the duration of the test. To obtain this the most accurate method is probably that involving the use of displacement tanks, by which the actual amount of free air used can be definitely determined. A meter of this type is shown in Fig. 2. It consists of two tanks (or small air receivers) and the necessary valves, gages, calibrated measuring scales, and other accessories. This meter is operated as follows:

The receiving tanks are shown at *A* and *B*, to which air is admitted through the reducing valve *L* and the inlet valves *C* and *E*. The air to be measured passes

from the tank *A* or *B* by way of the outlet valve *D* or *F* to the machine being tested.

In operation, a certain amount of water is required which will show in the gage glasses *I* and *J*. Air is admitted through one of the inlet valves, and one of the outlet valves is opened until the water takes a position which we will assume to be as indicated by the lines *M* and *N* on the gage glasses *I* and *J*. This is possible by means of the quick-opening gate valve

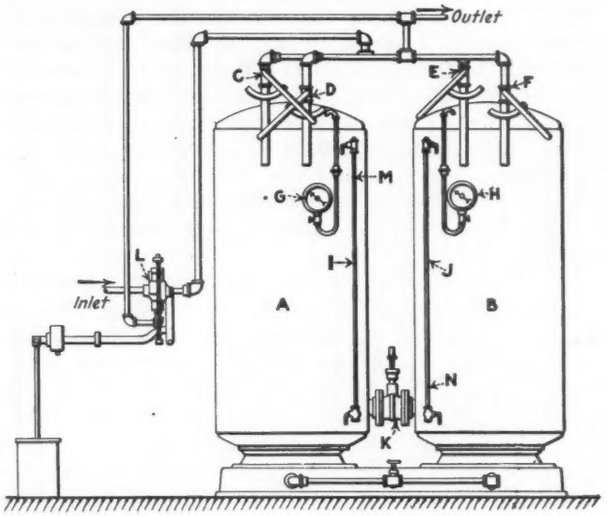


Fig. 2—Displacement type of air meter for determining air consumption of pneumatic tools

shown at *K*, which, when open, permits the water to pass from one tank to the other.

When the water is in the proper position to register the displacement of the amount of air used, the machine to be tested is connected to the outlet pipe of the water by the necessary hose and connections, and the throttle valve is set in the closed position.

The inlet valves *C* and *E* are then opened, this admitting air to the receivers *A* and *B*. The pressure in both tanks will become balanced. After the pressure in the receivers has become balanced (which is easily determined by the gages *G* and *H*) and with the water registering as assumed at points *M* and *N* of the gage glasses, a rubber band is set at *N* to indicate the height of the water in the tank. The inlet valve *C* is opened and the valve *E* closed. The outlet valve *F* is opened and the valve *D* closed. When the throttle valve on the machine being tested is opened, the air under pressure will enter tank *A* through the inlet valve *C* and force the water through the gate valve *K* (which is in the open position) into the tank *B*. This will keep a constant pressure on the air in tank *B*. The air in tank *B* will pass through the outlet valve *F* to the machine.

When the machine has been run the desired length of time, the gate valve *K* is quickly closed, thereby stopping the flow of water from tank *A* to tank *B*. The height of the water registered in the gage glass above the rubber band, previously set, will indicate the displacement of the air used. This can be read in terms of cubic feet of free air by means of graduated scales which are calibrated for the various pressures.

On the next run of the machine, the adjustment of the valves is reversed, and the air for the machine being tested is drawn from tank *A*—that is, the inlet valve *E* is opened and the valve *C* closed. The outlet valve *D* is opened and the valve *F* closed. The rubber band on the gage glass *I* is then set to indicate the height of the water, and the machine and gate valve *K* are operated as previously described.

The reducing valve is a convenient accessory. In addition to performing its function of keeping the air entering the tanks at a uniform pressure, it permits the testing of the machines at pressures lower than the line pressure to which the meter is connected.

Leakage of Air Must Be Considered

In practice, owing to faulty connections and fittings, there is generally a certain amount of leakage; that is. air passes through the meter, but escapes to the atmosphere before it reaches the machine. This loss of air must be taken into consideration to obtain accurate results in regard to the amount of air used by the machine. To determine this loss, the meter is properly set for operation, the rubber band on the gage glass is properly set, and the throttle valve of the machine is kept closed. After the lapse of the desired time the gate valve *K* is closed and the loss of air measured. This will be indicated by the distance that the water has risen in the tank from which the air is drawn.

If accurate results are desired, the amount of air thus indicated should be deducted from the amount registered when the machine was in operation for the same period of time.

Results of Drilling Speed Test and Air Consumption Tabulated

Having determined the drilling speed and also the air consumption at various pressures, we have a record of the results similar to the following, which was made from one minute runs on each size of bit:

Size of Bit	Inches Drilled
1¼	10
1½	11½
1¾	13
Total	34½
Average	11½

Air pressure, 80 lb. per sq.in. Air consumption, 109 cu.ft. per minute.

Size of Bit	Inches Drilled
1¼	11½
1½	13½
1¾	15
Total	39½
Average	13¼

Air pressure, 90 lb. per sq.in. Air consumption, 129 cu.ft. per minute.

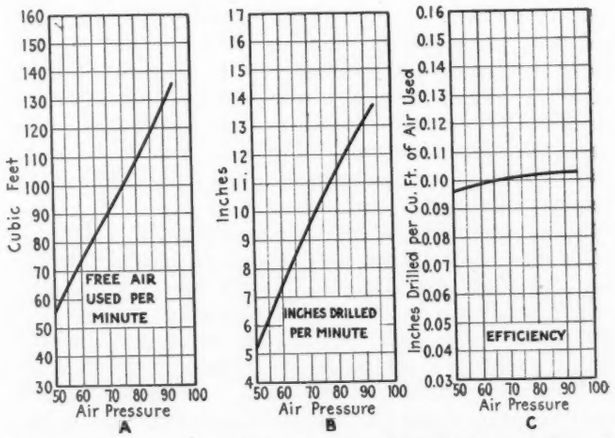


Fig. 3—Charts showing results of drilling speed and air consumption tests

Corresponding records will be obtained for the other pressures at which the rock drill is tested.

The average of several runs is generally used when the curves described in the following are made. Fig. 3 denotes the method of plotting curves to show the average results obtained from the drilling speed and air consumption tests.

Chart *A* in Fig 3 indicates the cubic feet of free air used per minute at various pressures. Chart *B* indicates the amount drilled per minute. The average of all runs made at indicated pressure is used. This position is located on the chart for each pressure at which the machine is tested and the points are connected to form the curve. Chart *C* indicates the efficiency of the machine. The points for locating this curve are obtained by dividing the number of inches drilled by the number of cubic feet of air used. This curve shows the inches drilled per cubic foot of air; that is, inches drilled divided by the cubic feet of air used gives the efficiency.

Force of Blow and Number of Blows Delivered Per Minute Determined

As stated above, machines have been designed for the purpose of recording the force of the blow and number of blows delivered per minute by the piston (or hammer) of rock drills. Some of these testing machines have attachments which record, in the form of a graph on a strip of paper, the air pressure at which the machine was tested, the cubic feet of free air per minute used by the machine, and also indicate the elapse of one second intervals of time.

The arrangement of the mechanism for registering the force of the blow delivered generally consists of a plunger that operates in a cylinder. A port connects one end of the cylinder to a space back of a diaphragm, to which is attached the necessary lever movement and pencil for recording the vibrating action of the diaphragm upon a paper strip. The space between the end of the plunger and the diaphragm is filled with oil. It follows that a blow upon the plunger will be transferred by the oil column to the diaphragm, causing it to deflect in proportion to the blow. The deflection will be recorded on the paper strip by means of the lever movement and pencil.

Fig. 4 represents a graph obtained in the test of an air-feed stoper-type drill with the arrangement just described. Line *A* represents the location of the marker at zero air pressure. Line *B* represents the pressure due to the air feed arrangement. The drum carrying the paper roll was run and the machine operated with the result that line *C D E F* was obtained. The height of the line *C D* represents the force of the blow delivered, from which, by the proper calculations, it is possible to obtain the force of the blow expressed in foot pounds. The line *D E F* indicates the action of the diaphragm in assuming its normal position.

To determine the number of blows delivered by the piston (or hammer) per minute, it is necessary to indicate a specified lapse of time on the paper upon which the graph is being recorded. Line *G* is used for this purpose, points as shown at G_1 being made at the expiration of each second of the run. By counting the number of blows registered between these indicated points we determine the number of blows struck per second; thus, if the average number of indicated blows per second equals twenty-one we are safe in stating that the piston is delivering 1,260 blows per minute.

If the testing machine is arranged to record the air pressure and air consumption, the paper upon which the graph is drawn should be properly ruled, the space between the lines being such as to indicate a specified increase in air pressure or air consumption.

Properly designed devices can be used to draw a line on the chart from which can be read directly the air pressure at which the machine is tested and the cubic feet of free air used per minute. The devices for recording air pressure and air consumption are not absolutely necessary, as it is possible to obtain these data from other sources. They are, however, convenient, in that they keep the desired data together and easily available for future reference.

Wearing Qualities of Materials Used Tested

Tests to determine the wearing qualities of the material from which the various parts of the machine are made are being conducted continuously. Parts are made of materials of various composition and given

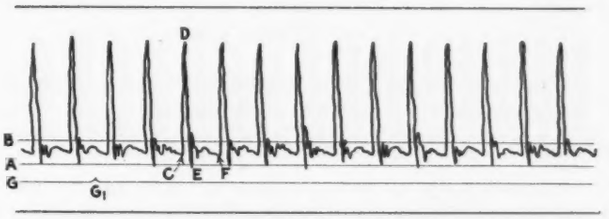


Fig. 4—Graph showing force of blow delivered by rock drill piston; also number of blows struck per minute

different heat-treatments. These parts are subjected to abuse much more severe than any that they are likely to be subjected to in actual service. For example, pistons are made to hammer continuously upon a steel block, this test being carried on for hours until the piston is finally broken by the severe treatment. To test the material used for making the side rods, the piston is permitted to hammer against the front head of the machine until the side rods are broken.

Similar tests are made on other parts that are subjected to heavy stresses, to determine the best material for each particular part. Accurate records are kept of the various tests made, and when a material or method of heat-treatment is found that has a tendency to lengthen the life or wearing qualities of any of the parts, this material or method is substituted for that in use.

One of the outstanding points to be featured in placing a rock drill on the market is the amount of maintenance work and the cost of upkeep of the drill. Therefore users of these machines can rest assured that the best possible material is used in the construction of them, with the object of keeping the cost of repairs at the lowest possible figure.

Approval of Users of Rock-Drill Sought

The ultimate success of the machine depends largely upon its operation and action, but also upon the approval of its users. Thus a rock drill may be an exceedingly rapid driller, yet not obtain favor with the men called upon to operate it. Various causes may be responsible for this disfavor. For example, if the valve action is slow, the piston action will be sluggish; or, again, excessive vibration may make it difficult for the operator to hold the drill in the proper position. Such defects are fatal to the adoption of the machine by the trade.

During the development stages, the machine is carefully observed for indication of objectionable features which may have a detrimental effect upon its sale. Great care is exercised to produce a machine with smooth action and freedom from vibration. At times, drilling speed will be sacrificed to obtain these features and to secure a machine which is easier to handle and hold in the proper operating position.

Space will not permit my going into detail in regard to the method of testing and inspecting all of the parts that comprise a rock drill. Limit gages are used on all machined parts so that the variation in the size is held to a small margin, seldom exceeding more than a few thousandths of an inch. The amount of tolerance depends upon the part and the necessity of holding it to close limits.

The piston (or hammer) is generally run in a special machine for a specified time, so that any flaws, such as water cracks due to hardening, will be found.

Valve motions are assembled and tested as a complete unit before being placed in the storeroom from which they are drawn at the time of assembling the complete machine.

Cushion springs are compressed in a specially designed machine until they are closed tightly. When the pressure on the spring is released it must return to its original length or it will be rejected.

Other special instances might be cited, but I believe the above is sufficient to enable the reader to obtain a general idea of the care that is used in the examination and manufacture of the parts that go to make up a rock drill. This care is necessary so that every part ordered and sent out as a repair part will be an exact duplicate of the part that is to be replaced and the satisfactory operation of the machine will be insured.

After the complete drill has been assembled, each machine is tested, and it must come up to drilling specifications for various sizes of bits before it is passed by the inspector.

The outline of procedure which has been given here may, of course, vary with different manufacturers. It is probable that methods will vary at different factories of the same company, as the managements of the various works have their own ideas for accomplishing the desired results.

Although it is impossible, under these circumstances, to give a detailed description that will apply to all cases, the one here outlined should serve the purpose of giving the users of rock drills an idea of how the machines are tested and what care is taken to insure that they receive the best product that it is possible to manufacture.

Material for Geophone Diaphragms

An investigation conducted by the U. S. Bureau of Mines to determine the most suitable material for geophone diaphragms showed that in mica diaphragms the thickness was not an important factor. Metal diaphragms were not only more satisfactory than mica, but their sensitiveness increased with thickness until a point was reached when a ringing tone was produced, and the diaphragms therefore became useless. With the exception of Non Gran bearing metal, a material 0.025 in. thick was the thickest that could be used. With Non Gran bearing metal, however, a diaphragm 0.035 in. thick was satisfactory.

To determine the sensitiveness of the diaphragms, observations with the geophones were made on blows struck with a 5¾-lb. hammer swung as a pendulum against the coal at a distance 400 ft. away from the observer. The swing of the pendulum was measured, and the shortest swing that could be detected with the geophones was recorded. The results obtained at the experimental mine with the different materials are given in Technical Paper 277, just issued.

Barium and Strontium in Canada

The hitherto exploited occurrences of barium and strontium minerals in Canada are all situated in eastern Canada, and chiefly in Ontario and Nova Scotia, according to the Department of Mines, at Ottawa. Barytes mining has had its greatest development in Nova Scotia, the important deposits at Lake Ainslie having furnished the bulk of the barytes produced in Canada. A number of small, scattered deposits occur in southeastern Ontario, but these are not considered of great economic importance. In recent years, important bodies of barytes have been discovered in northern Ontario. Unfortunately, some of the most promising deposits in this region are situated too far from a railroad to permit of their exploitation at the present time. Large deposits are also said to occur in British Columbia near Spillimacheen, on the Kootenay Central R.R., but no development of these occurrences has taken place.

With the exception of a few hundred tons produced in the Lake Ainslie district, Nova Scotia, there has been practically no output of barytes in Canada for several years. The cause for this inactivity would appear to be not lack of barytes but the comparatively low price at which barytes has been selling. Barytes is produced very cheaply in Missouri, Georgia, and Kentucky, the mineral occurring as lumps in clay and being dug out by hand (in Missouri) or by steam shovel (in Georgia). Canadian barytes costs more to mine, and many of the deposits are remote from the consuming centers. Also, Canadian vein barytes is often harder and more difficult to grind than the soft Missouri barytes.

The only strontium mineral of importance occurring in Canada is the sulphate of strontium, celestite, which is known in possible economic quantities in southeastern Ontario only. The known deposits are not large, but, in one or two instances, are regarded as capable of successful exploitation, should an active demand for celestite arise. Most of the celestite consumed on the American continent is imported from England, and is used principally for the preparation of strontium hydrate, which is employed in the refining of beet sugar. In the manufacture of fireworks strontium salts are used to produce red fire.

Testing Dust at Pittsburgh

Comparative tests on dust are being conducted by the U. S. Bureau of Mines, in co-operation with the U. S. Public Health Service and the Bureau of Chemistry, at the Pittsburgh, Pa., experiment station. The experimenters are using the sugar tube, Palmer water-spray apparatus, the paper thimble filter, and the konimeter, which impinges a small volume of air at high velocity against a plate made sticky to catch dust.

A test on iron dust was made by suspending a weighed amount in the air of a gas chamber, stirring until uniformly distributed and then taking simultaneous samples. Analytical processes were carried out to give numbers of particles per unit volume of air, weight and distribution of the sizes of dust. The characteristics of the different instruments and the relative efficiencies will be obtained from the results. Figures on the first test are not yet available, but it appears that greater regularity is being obtained on consecutive samples than are obtainable in the field.

Surface Tension and Flotation Phenomena

Zinc Shavings and Tin Foil, With a Few Drops of Oil and a Medicine Dropper, All That Were Needed in Simple Tests To Show Fundamental Reactions

By D. W. Leeke and R. H. Jarvis

THE DIFFERENT PHENOMENA connected with the surface tension of liquids have been given much attention of late, especially in connection with the theory of flotation. It has been known for some time, and proved beyond a doubt, that oil as applied in the flotation process reduces to a marked degree the surface tension of the water with which it is mixed. In a recent article in the *Mining and Scientific Press*, this reduction of the surface tension by the addition of different kinds and different amounts of oils was well explained. The author[1] had devised a neat and ingenious machine whereby these various surface tensions were measured. The thoroughness of the descriptions and the explanations in this article added markedly to its instructiveness.

This introductory paragraph brings us to the matter in hand—namely, the description of some simple experiments that we have carried on to throw further light on the subject of surface tension as well as the theory of flotation. The following experiments are not brought forth as conclusive proof for any one theory, but are jotted down mainly because they are new and interesting, and undoubtedly hold some value in themselves in adding further knowledge to this broad subject.

Almost every one who has been around mines and mills is familiar with the ordinary zinc shaving as cut by the lathe that prepares the material for use in the zinc boxes. The purpose of this is to precipitate gold from the cyanide solution flowing through and over it.

How the Zinc Shaving Was Made

A piece of this zinc shaving, new and bright, from ½ to ¾ in. long, was cut off from the long strip. Both ends of this piece of shaving were made to turn or curl up by the pressure of a knife blade on the shaving at a distance of ⅛ in. from each end of it. This sketch will serve to illustrate: ⌣+⌣ . The sign is given to differentiate it in this article from the zinc shaving turned the other way and having the *minus* sign, as ⌢−⌢ ; for it will be brought out in the subsequent description that their behavior as they lie in these positions on the surface of various liquids is diametrically opposite.

An ordinary drinking glass was filled three-quarters full of clear water and one of the *plus* shavings was dropped on the surface of the water, the ends being bent up as shown. The forces acting on the shaving seemed unbalanced, for it started at once to move toward the side of the glass, and when from ⅝ to ½ in. from the side it took a head-on movement with accelerated speed, and climbed up well onto the meniscus, remaining normal to a tangent at the periphery of the glass. It was found that shavings of this shape were greatly attracted by the meniscus, and when within range of its apparent attraction at once darted head-first for it; whereas a shaving placed in the water in the *minus* position remained sluggishly in the center of the glass, or if forced near the side of the vessel, approached it slowly with little or no acceleration, and side-on to the vessel, or normal to a radius.

Bubbles Strongly Attract "Plus" Shavings

The same phenomena were noticed when ordinary tin-foil strips were used instead of zinc shavings. In another experiment some of the same *plus* shavings were placed on the solution in the cyanide-mill zinc boxes where the hydrogen bubbles were rising continually to the surface. It was astonishing to note the attraction that these zinc shavings had for these bubbles. The shaving, when within half an inch of a bubble, would suddenly dart head-first for it, often striking the bubble with such violence as to cause it to burst. In the event of the bubble not bursting, the *plus* shaving would come to rest quite high on the convex surface of the bubble.

This decided attraction which bubbles have for the *plus* shavings was also noticed markedly in the "thickener" froth. A few of the bubbles were captured and placed on the surface of some water in a vessel, and a *plus* shaving was dropped carefully in; the accelerated speed with which the shaving hit the bubble head-on was especially noticeable.

The conclusion drawn from the experiment noted was that the meniscus formed by a *plus* shaving in the water was the same upward-curved meniscus as formed around the side of the water glass, as well as the same surrounding or actually made by the different bubbles. Surface tension was the force causing the attraction of the larger menisci curve, for the smaller one formed at the head of the *plus* shaving when floating on the water. Upon the *minus* shaving, having a downward curved meniscus, the surface tension of the opposite meniscus had little effect. At least, the fact that like curvatures attract was conclusively demonstrated in the following experiment:

When the drinking glass was filled almost to overflowing so that the surface of the water stood higher than the edge of the glass, thus reversing the curvature or angle of the meniscus, making it a downward curvature, then the *plus* and *minus* zinc shavings behaved in just the opposite manner in which they behaved before, when the glass was only partly filled with water. The *plus* shaving tended to remain in the center of the containing vessel, and if forced near the edge, approaced it slowly and sidewise; whereas the *minus* shaving dashed head-on with accelerated speed for the side of the vessel, gaining such speed as to send it over the edge of the water-glass and downward on its outside.

The Effect of Oil on the Phenomena

Next, a drop of ordinary light engine oil was dropped upon the surface of the water in the glass near its center. A *plus* shaving was placed upon the surface of the water and brought to within about ⅜ in. of the

[1] A. W. Fahrenwald, "Surface-Energy and Adsorption in Flotation," *M. & S. P.*, Aug. 13, 1921.

oil drop or within the radius of its influence of attraction for the *plus* shaving. The latter moved in a sidewise manner slowly toward the oil drop and hit it normal to a radius through it. In a short time this *plus* shaving broke the interface between the oil and the water and entered the oil drop; it came to rest finally at the center of the drop at the lower interface between the oil and the water. Upon experimenting with floating small particles of both zinc and lead sulphides, it was found that in the case of the oil drop on the water they acted precisely as did the *plus* shaving; that is, they entered the oil. On the other hand, when a *minus* shaving was introduced near the oil drop in a like manner, a different phenomenon was observed. The oil had a marked attraction for the *minus* shaving, and when near the oil the shaving started head-first with accelerated speed for the oil drop. On hitting the drop it came to rest and remained stationary there, with one end just at the interface between the oil and the water, the other end projecting back into the water. This *minus* shaving went no farther than the interface, and seemed not at all inclined to enter the oil drop.

It was found that a small particle of quartz would also float on water without previous treatment, and that this quartz particle acted in precisely the same manner in reference to the oil drop as did the *minus* shaving; that is, there was a marked attraction by the oil for the quartz, yet it always remained outside the oil at the interface. These experiments were found to hold good when liquids other than water were used. However, the more viscous the liquid, the less rapid was the movement of the shaped zinc shavings.

Our next experiment tends to prove that the adhesive force between oil and metal shavings is far less than the adhesive force between metal shavings and water. A layer of oil about ⅛ to ¼ in. thick was placed on top of some water in a glass container. Zinc shavings were introduced on top of this layer of oil, and almost immediately they became "wetted" by the oil and sank through the oil until they came to rest again at the interface between the oil and the water. The shavings of both forms, before they sank, seemed to have the same tendencies of movement as they did on the water, but acted much more sluggishly and with far less acceleration. In this same experiment, while these same zinc shavings were at rest at the interface between the oil and the water, bubbles, both large and small, were made to adhere to them by means of blowing bubbles near them in the oil with a medicine dropper. The bubbles seemed to have great tenacity and tended to remain on the shavings for some time.

Flotation Without Oil

An experiment in flotation without oil was carried out as follows: A few bright pieces of both zinc and tin-foil shavings about ⅛-in. long were placed on top of some water in a glass container, where they floated about until they were forced to sink to the bottom of the glass. They were then made to come to the surface once more, where they would again float, by inserting the dropper into the water to the bottom of the glass and then blowing a quantity of bubbles both under and about the shavings as they rested on the bottom of the vessel. The bubbles carried the shavings to the surface. Several pieces of bright tin foil, a quarter of an inch square, were sunk in like manner in a glass of water and were easily brought back to the surface again by means of the dropper bubbles. Once there, they remained afloat.

One other interesting experiment with tin foil was performed as follows: Bright pieces of foil about half an inch square were placed both on edge and flat in the water on the bottom of the glass. Then many small bubbles, blown by means of the dropper, directly on the bright metallic surface, would remain clinging there. Only the more minute bubbles would cling to the bright surface, the larger bubbles breaking away and refusing to adhere. From the fact that the bubbles would adhere only to bright metallic surfaces, refusing to adhere to tarnished or oxidized surfaces, one other desirable attribute of oil in flotation is brought to light—namely, an ability to restrain oxidization on the surface of the sulphide or other particles to be floated.

A piece of pure lead foil was next used. The tarnish or oxide was removed from its surface by rubbing it with cotton wool under water. On submerging it at once in the container, small bubbles were made to adhere to it. However, it was impossible to make any bubbles whatsoever adhere to the customary blackish surface of the lead foil. From the static theory, it is a well-known fact that the films of oxides so readily formed on most metallic surfaces tend to lower the potential of a metal.

Oil Prevents Oxidation

Another experiment was tried that showed the properties of oil as an insulator against chemical action. A thin piece of sheet zinc was dropped into a nearly saturated solution of copper sulphate. This zinc, of course, was readily blackened by the deposition of copper, and eventually the zinc was almost entirely replaced by the copper, appearing like lace, and finally disappearing. Then a similar piece of zinc was well oiled with the same engine oil as was used in the former experiments. This oiled zinc sheet was dropped into a like solution of copper sulphate. The extraordinary way in which chemical action was retarded by the oil was at once apparent. After a long time only the edge of the foil, from which the oil had wholly or partly receded, was attacked, being blackened by the deposition of the metallic copper.

It would appear from these few simple experiments that oil plays a twofold rôle in flotation. First, it reduces the surface tension of the water, and, second, it insulates or prevents oxidization on the freshly exposed bright surfaces. One or two striking analogies come to mind. One is that both graphite and molybdenite, two minerals least readily oxidized, stand high in the list of easily floatable minerals. To show how readily metals oxidize, one recalls that in Low's iodide method for copper analysis, in the step where the metallic copper is precipitated on the aluminum, it is essential to keep hydrogen sulphide present in the solution and the wash water to have the common ion always present and thereby reduce the oxidation of the newly precipitated fine copper particles to a minimum.

Little heretofore has appeared in print on the subject of experiments with metals, oil, and water, and therefore these simple experiments may be interesting to students of flotation. We purposely have drawn few deductions. We have tried merely to explain carefully the experiments as made, leaving profound conclusions to the more advanced theorists on this interesting subject—the winning of metals by flotation.

The Las Minitas-Baucarit Gold Belt

A Low-Grade District in Sonora Worked Many Years Ago—Deposition Associated With Igneous Activity —Small Stamp Mills and Cyanide Plants Erected

BY FERNANDO MONTIJO H.

LAS MINITAS-BAUCARIT gold belt, in Sonora, is reached from the town of Navojoa, on the main line of the Southern Pacific of Mexico, by going west along the Mayo River to Siquisive, and from there in a northwesterly direction to the ranch of El Mesquite. Las Minitas is about five miles south and Baucarit three miles north of El Mesquite. The distance from Navojoa is about twenty-five miles over a good road.

The belt runs along a shallow north-and-south valley separated by a line of low hills from the Cedros River valley to the east and by a chain of larger hills from the plains of agricultural lands to the west. The low hills are of hornblendic granite; the larger ones of finely vesicular lava, probably an andesite. The valley is almost totally covered by alluvium consisting chiefly of sand derived from the disintegration of the granite. It is easy to notice the gradual passing of the weathered but still coherent rock on the hills to the loose sand at the bottom. The lava is a less decomposed and newer formation.

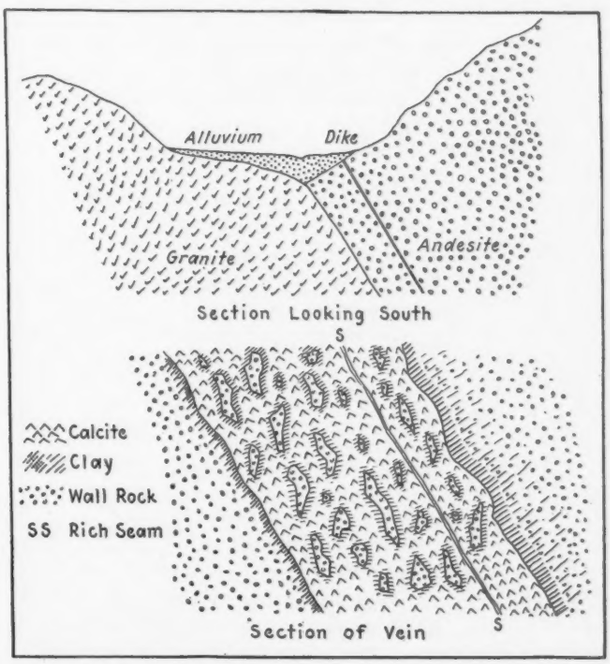
The contact is near the center and bottom of the valley; it is covered by alluvium toward the south, but to the north it appears on the surface, where its plane dips 65 to 70 deg. west. No evidence of metamorphism was observed. That the lava pour abutted against the older granite seems to be a reasonable explanation of their relation.

Two lava dikes outcrop above the alluvium in a few places. They are within the lava formation, and consist of rock of nearly the same composition as that of the parent lava. Being less weathered, their outcrops stand out. A system of more or less parallel veins strikes approximately north and south. The main vein is in the contact of the granite and lava but running out into the lava along the contact of one of the dikes. This relation, however, is only surmised so far as the place where the vein leaves the main contact and jumps to the dike contact is concerned.

It is not known whether the dike comes close to or touches the granite. No observation was possible, on account of the alluvium covering at the spot. A discontinuity may exist, and the main vein in the lava-granite contact to the north may not be the main vein in the dike-lava contact to the south. According to the general direction and the characteristics of the vein matter, as well as the dip, it should be the same vein. If it is the same, it has been seen for no less than a total length of eight miles, where it outcrops above the alluvium. Important veins, of less width but of somewhat higher grade, lie wholly within the granite, and others, less important, wholly within the lava.

The main vein has been worked and exposed in the Junta and other lesser mines. The La Junta has three levels and a vertical depth of 220 ft. and drifts 180 ft. long. It has been worked by a vertical shaft cutting the vein at the second level. At the La Junta the vein strikes west of north, dips 70 deg. southwest and is 29 ft. wide. It lies in the contact of one of the lava dikes and the older lava, the dike being the hanging wall. The gangue is calcite and included portions of altered wall rock; there is very little quartz or other siliceous material. The first six feet of width next to the hanging wall average in value close to $8 per ton (four-fifths of the value being gold and one-fifth silver); the rest of the distance to the foot wall has a value of about $3 per ton. Short lengths of ore along the hanging wall drift run as high as $40 per ton and isolated assays give a value of over $200.

The metals hold in the third level, which is yet within the oxidized zone. The gold occurs in two different modes: first, invisible sizes concentrated in rusty specks



Geological cross-section of part of the Las Minitas-Baucarit district and one of its veins

in the calcite, in fact, calcite that is not so specked (*mosqueado* or fly-specked is the local name) is low grade and not worked; second, coarser gold in grains up to one millimeter in diameter along one seam less than half an inch wide close to the hanging wall but not quite parallel with it and some branches running at an angle to the foot wall. It is the stringer within the vein that raises the grade in certain points. Some wire gold in little bunches the size of a grain of corn has been seen near the rich seam and in a miarolitic spot between the first and second levels. Only part of the silver appears to be alloyed with the gold, the rest being in the form of chlorides. The visible gold is quite yellow, and the relation of values of the two metals varies from place to place, though not widely.

Besides the precious metals manganese occurs in the

calcite in cloudy stains, making it black in places, and in powdery fillings of seams, and, of course, the iron that forms the rusty specks fills seams and joints with the manganese and permeates all vein matter, making it red. Both hanging and foot walls are decomposed and somewhat impregnated with metals; assay values of $1.50 per ton have been obtained two feet away from the vein in the hanging wall in the band of residual clay grading into the altered country rock. A narrower clay selvage is found in the foot wall and around chunks of altered country rock within the vein. From these observations it is thought that the calcite gangue was derived from the lime-soda feldspars of the andesitic wall, decomposed along waterways, the calcite being carried away to be redeposited and the residual clay left behind. Assays of the country rock at a distance from the vein gave only doubtful traces of gold in some samples of the granite and some of the lava: (however, only four assay-ton samples were assayed).

It is not likely that the deposits are entirely due to lateral and descending secretions, for there is not enough decomposed rock beyond the walls for all the calcite in the vein. Ascending solutions, from a proximity to a magma of the same composition as the lava, probably account for the calcite, together with the iron, manganese, and precious metals. Moreover, the calcite, with the metallic oxides and metals, occurs in the veins within the granite, which, though more siliceous, nevertheless support the theory of deposition by ascending solutions. The coarser gold along the rich seam must be a deposition secondary to that of the finer gold and may be due to a replacement by iron (with gold) of the calcite along certain cracks and joint planes. A great portion of the vein must have been eroded away, together with everything else at the surface of the ground; indeed, samples of the alluvium from almost anywhere in the valley floor, especially the dry creek bottoms, will always show some gold, which must come from the eroded portions of the vein.

Elsewhere the main vein has not been observed in mine openings greater than 30- to 50-ft. shafts. In all such places the characteristics of filling show no significant variations. To the north the old Baucarit mine is said to have reached 600 ft. of vertical depth and to have yielded good profits, but when visited before this was written no access below was possible. On the dump fresh granite, together with lava rock, shows that the vein is on the contact as it appears to be at the surface. The vein matter, though calcitic, appears to be more siliceous than in La Junta. At present the old Baucarit is being reopened. Besides the La Junta and Baucarit, the Zorra Negra and the La Prieta mines have been worked to a greater or less extent in what is taken to be one and the same main vein.

All other veins have no more than prospect ditches and shallow holes, some showing assay samples running in value as high as $30, but in no case is the vein wider than four feet; others assay less than $2 in value in a wider vein. In general, none is considered likely to develop into a mine of better grade ore than that in the main vein in La Junta. The characteristic calcite is always found, but the gangue in the granite is more siliceous.

None of the mines in the belt has ever been worked on the basis of a large-tonnage, low-grade operation, as evidently they should be if worked at all. The La Junta has a ten-stamp mill, amalgamating plates, and cyanide sands plant; the La Prieta, a five-stamp mill and sand leaching tanks, and ten-stamps are being installed at the Baucarit. Elsewhere native arrastres are used.

All mines are worked but sporadically, always trying to "high-grade" out the better ore. It is known that at La Junta, in a run of several months, ore was mined at the rate of eighteen tons a day, milled, and the sands cyanided, all for a total cost of $5.50 per ton, but there was $0.50 left in the sand tailings, and the slimes, in quantity somewhat more than the sands, were not treated, so, although the mill heads were $8 per ton, there was an operating loss. It seems that, after blocking out enough tonnage, ore of $7 to $8 per ton could be worked at a profit with a large enough daily output and the proper mining and milling plants. The main item of expense in the mine is timbering. The ground is heavy, and the hanging wall tends to slough off in large slabs, diluting the ore. The milling and treating costs of this soft, easily cyanided ore should be very low.

California's Gold-Mining Industry Recovering

Metal mining in California during the first half of 1922 showed some improvement over the first half of 1921, according to Charles G. Yale, of the U. S. Geological Survey. The improvement, however, was mainly in gold mining, for the mining of other metals showed a decrease in output. During the first six months of 1922 the U. S. Mint at San Francisco and local smelters and refiners received from the mines of California $7,721,258 in gold, $371,140 more than during the first six months of 1921, when the receipts were $482,000 less than in the first six months of 1920.

The silver received during the first half of 1922 by the mint and local smelters and refiners amounted to $1,440,842, valued at $1 an ounce, or $157,147 less than in the first half of 1921, when silver was valued at $1.09 an ounce. This decrease is due to the continued idleness of most of the large copper and lead producing mines, from which much of the silver mined in California is derived. The silver mines in San Bernardino County are increasing their output somewhat, but not sufficiently to counteract the loss in the output of copper and lead ores. The mines that now produce the most silver are the California Rand, Inc., the Grady lease on the same mine, in San Bernardino County, and the Engels copper mine, in Plumas County.

The gold-mining industry is slowly recovering from the effects of the war, but a number of the mines still continue to work under restrictions and few large deep mines or placers are being started. The increase in the output of gold appears to be coming partly from an increasing number of small mines, both deep and placer, that are worked by their owners or lessees, rather than from the properties of the larger companies, but the increase is mainly in the output of the dredges, more gold coming from the dredges now than from all the deep mines in the state. The ratio of increase in the output of gold from the deep mines is about 4 per cent and that of the increase from the combined placers, including dredges, is 15 per cent. The water supply for the hydraulic and other placer mines has generally been good, but it came a month or more later than usual owing to cold weather and the packing of snow on the mountains.

Milling Graphite at Stockertown, Pa.

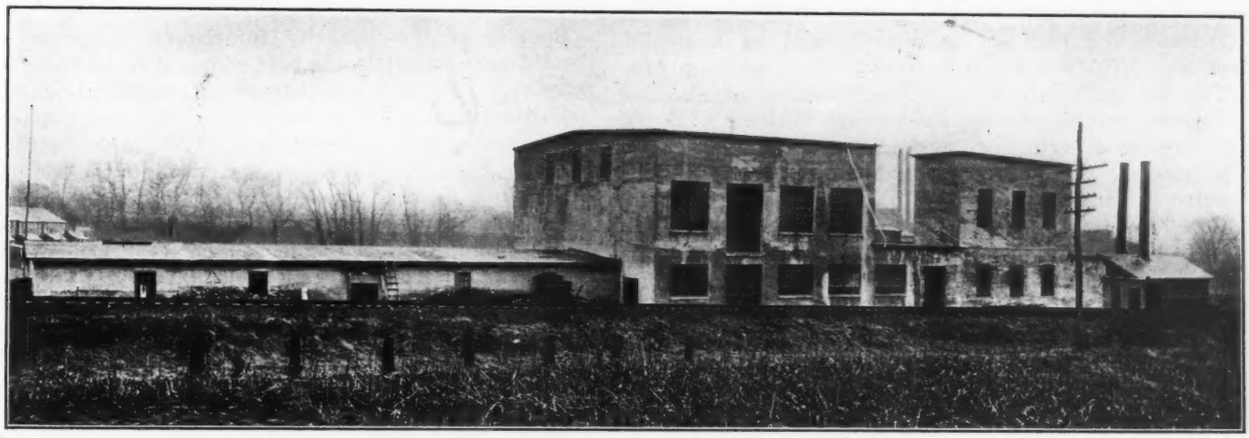
Description of the New Plant of T. P. Kelly & Co.—Reinforced-Concrete Construction—Mechanical Handling of Material—Ball Mills and Buhr Stones Used for Grinding—"Air" Sizing of the Product Is a Feature

By ARTHUR B. PARSONS
Assistant Editor, *Engineering and Mining Journal-Press*

GRAPHITE is soft and easily ground. However, for a great many uses it is necessary to obtain a product of which 99 per cent is finer than 200 mesh, and in which no particles coarser than 100 mesh are included. To build a plant that would accomplish this effectively and economically, and that at the same time would minimize the cost of operation and of equipment upkeep, was the object of V. C. Smith, vice-president and superintendent for the firm of T. P. Kelly & Co., when he designed the company's new grinding plant at Stockertown, six miles northwest of Easton, Pa. The former plant was totally destroyed by fire late in 1920, so that an opportunity was offered to put into practice the lessons learned by the experience of a number of years of operation. The policy adopted was to construct the most efficient mill rather than to economize on first cost. For these reasons a description of the plant should be of interest not only to graphite millers but to others who have similar problems in the fine grinding of dry materials. As a matter of fact, some of the products made in the Stockertown plant contain coke, some clay, and some small proportions of other materials, which are mixed with the graphite before grinding.

The flow sheet of the plant is simple, and a description of the principal features in which the new plant differs from the old will serve to give an excellent idea of the process. The changes may be enumerated, in what is perhaps the opposite order of their importance, as follows: (1) Use of reinforced-concrete and steel construction throughout the plant; (2) introduction of individual electric-motor drives in place of an annoying steam-driven line shaft, and the division of plant into three distinct units; (3) installation of conveyors and elevators so as to avoid manual handling of material; (4) increasing the proportion of ball mills and making a corresponding decrease in the proportion of horizontal Buhr stones or "stone and emery" mills; and (5) discarding all "bolting" equipment in favor of "air-separators" for sizing the product.

Before discussing these topics I shall mention the sources of the raw material used and the products made at the plant. The greater part of the crude is crystalline graphite from Ceylon. It comes in barrels, and may be either in the form of 4-in. lumps or of finer sizes. It averages 90 per cent graphitic carbon. From the Black Donald mine in Canada comes flake graphite of high grade, the product of froth flotation, and "amorphous" graphite, a term that is sometimes inaccurately applied to graphite that is so finely crystalline that it appears to be earthy. Madagascar supplies some flake graphite, and several companies with mines in Alabama ship a flotation product that is a comparatively fine flake. Amorphous material comes from Rhode Island and Korea. Some of the amorphous varieties contain as little as 40 per cent graphitic carbon. The explanation of this large variety of sources is that all of these kinds of material can be utilized for some one or another of the products, and that purchases are made in the general market when favorable opportunity offers.



General view of the T. P. Kelly graphite mill

The use of graphite that accounts for the largest consumption is, of course, the manufacture of crucibles The Kelly company is not in the crucible business, and it does not sell to the manufacturers, because they import and grind for themselves. Foundry facing, in point of quantity, is the most important output of the plant at Stockertown. This product need not be particularly fine, but Ceylon graphite must be used to make the best grade—that is to say the grade that gives cleanest castings in the foundry. Clay is ground with the graphite as a binder and filler.

For lubricants, flake graphite is the best material. Obviously, a high degree of purity is desirable, and the

presence of silica, even if finely ground, is deleterious. Lubricants for some purposes require that the flake be ground so that 99 per cent passes 200 mesh. On the other hand, unground flake graphite mixed with cylinder oil makes an excellent lubricant for some purposes.

Other products for which the Kelly company prepares graphite are: paint pigments, pipe-joint "dope," lead pencils, stove polish, dynamo brushes, steam packing, electric dry batteries, arc electrodes, and preparations used in electroplating, glazing, steel-cable making, case-hardening and other processes. About twenty distinct products are turned out at the plant, some of which are sold directly to the trade, while others go to manufacturers. The price per pound varies from a few cents up to a dollar.

Plant Is of Concrete and Is Absolutely Fireproof

To revert to the features of the new plant. The main buildings, including the material-storage structure, the mill building proper, and the warehouse for the finished product, cover an area of more than 15,000 sq.ft. All are absolutely fireproof, being constructed of reinforced concrete and fitted with steel sashes. The floors are all concrete and the roof is waterproofed by a special cement. The equipment is likewise immune from fire. The elevator housings are of sheet steel, as are also the hoppers, transfer chutes, and storage bins for products in process of grinding. Storage for raw materials is provided by the division of the building devoted to that purpose into fourteen hall-like compartments by reinforced-concrete walls. Each compartment is fitted with a steel skylight. The supports for the air-separating equipment on the second floor are of structural iron, and the same is true for sundry light machines on the main floor. The heavy machinery of course is on concrete foundations.

A list of the principal items of equipment is given in the following table:

Machine	Number of Units	Horsepower of Each Motor
Sturtevant elevators	6	3
Cutler steam driers	2	5
"Iron King" packers	3	7½
Sturtevant crushers	3	10
Raymond separators	3	20
Sturtevant "stone and emery" mills	3	25
Crusher, elevator, conveyor	1	30
Hardinge ball mills	2	50

Three Electrically Driven Units

This indicates the division of the plant into three units, two of which contain Hardinge ball mills, whereas the grinding in the third is done by the three Buhr mills. Steam was formerly the power used, and a single main line-shaft with a large number of belts transmitted the energy to the individual machines. The comparative advantages of the present method of power distribution, in affording elasticity and economy of operation, in minimizing lost time, and in promoting safety, need not be dwelt upon. It is fair to point out, however, that the change is in accord with the healthy attitude of progressiveness displayed by the Kelly company. The officials are not under the delusion that the fact that a thing has been done one way for fifty years makes that the best way.

Incidentally, equipment is standardized as far as possible. The elevators are driven by direct-connected motors, and, except as to height, are identical—Sturtevant No. 3 chain-and-bucket type; the crushers are all No. 1 open-door rotaries, made by the Sturtevant company. The first crushes to ½ in. as the material is received from the railroad cars, whereas the other two are set to crush to about ¼-in. just ahead of the grinding machines.

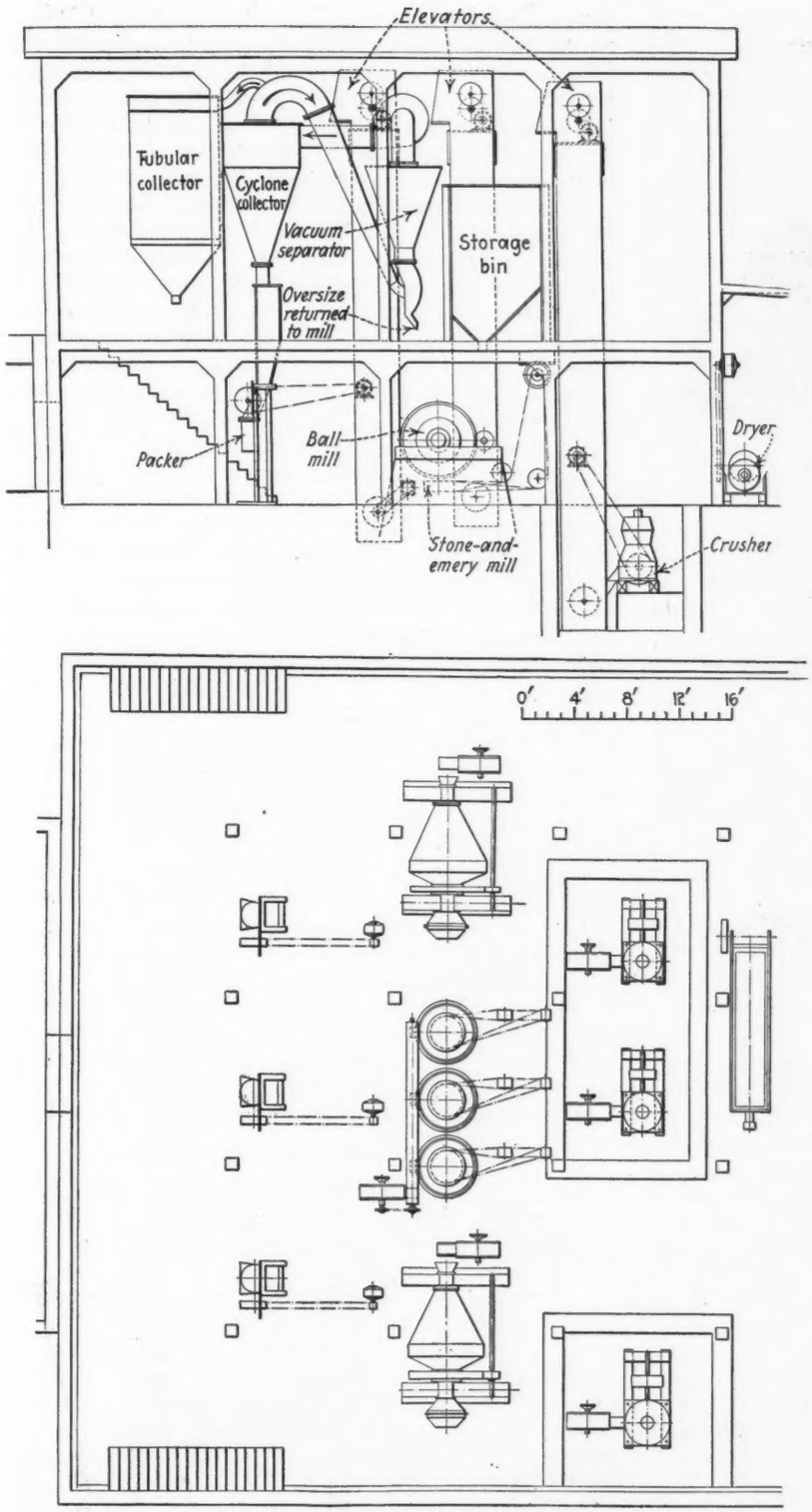
One of the faults of the old plant was that material had to be shoveled and wheeled in barrows, and fed a number of times by hand. The complement of men required to operate the plant at capacity has been almost cut in two by the introduction of new equipment. The raw material is unloaded from box cars into the hopper of the first rotary crusher. The crushed product goes to the boot of a bucket elevator, which carries it to a sufficient elevation to permit it to run by gravity to whichever of two screw conveyors it may be desired to divert it. These are 9-in. standard steel conveyors 80 ft. long, that travel transversely across the series of storage "halls," and that may discharge into the desired one. One conveyor serves the front, the other the back of the halls, which are 40 ft. long.

Mechanical Handling of Material a Feature

Because of the necessity for careful weighing of the different materials, the next step is done by hand, or rather by shovel and wheelbarrow. The desired quantities are wheeled to the scales, weighed and then dumped on the mixing floor. The mixture is either shoveled into the drier, from which it falls by gravity into the boot of an elevator, or it is scraped directly into the elevator boot. The maximum allowable moisture for efficient grinding and separating is about 5 per cent, and 85 per cent of the material used falls under this figure, so that little drying is necessary. The drier is a horizontal revolving drum fitted with a series of steam pipes running from end to end. The material being dried passes through the drier, as though it were a tube mill, coming in contact with the hot pipes as it proceeds. Subsequently, the process is automatic until the barrels or bags of finished product are trucked onto the scales for final weighing.

A small item, but one that it not unimportant, is the use of the American Kron Scale Co.'s Dormant scales for weighing both before and after grinding. The feature of these scales, aside from their being springless, is the ease of reading. A dial about 4 ft. in diameter is graduated to read from 0 to 1,500 lb., the weight being indicated by a large pointer. Allowance can be made for tare, and accurate readings can be made rapidly. Since these scales have been in use, it has been found that workmen are much less likely to obtain inaccurate weights than they were with the old style beam scales.

The next point is the matter of the grinding equipment itself. In the former mill there were five 42-in. "rock-and-emery" stones and one 6 ft. x 16-in. cylinder Hardinge ball mill. For foundry facing and sundry other products the ball mill was found to be most efficient, but for some the stone excelled, particularly where the material was all soft and a very fine-grained product was sought. For this reason, one unit of the new plant was equipped with stones and the other two were provided with ball mills, which, as has been explained, approximately reversed the proportions in the original plant.



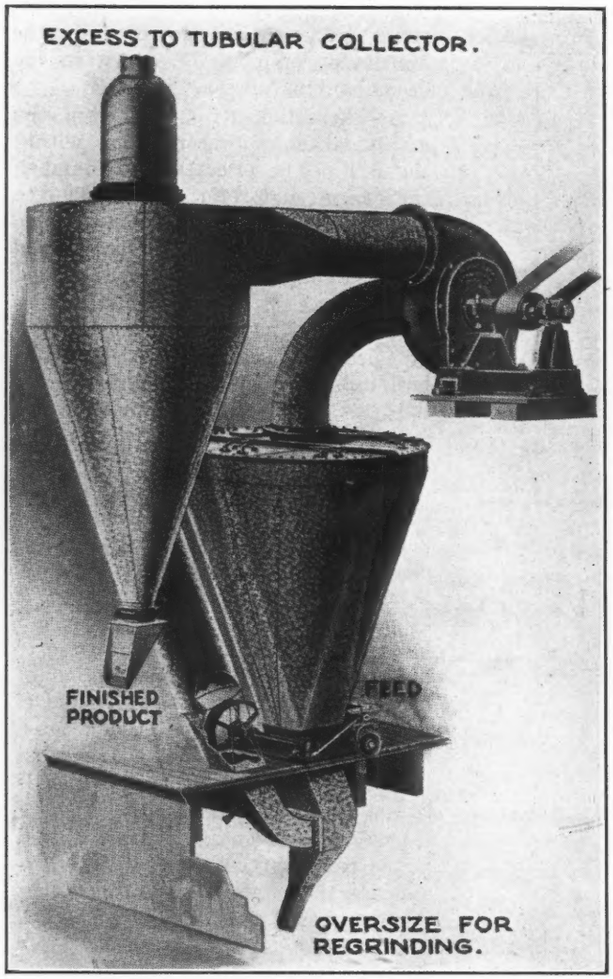
Plan and section of milling department

One of the early troubles with the ball mill was the inability of the scoop-type feeder to supply soft dry material rapidly enough. To overcome this a special feeder was developed. This consists essentially of a vertical 8-in. screw conveyor extending through the trunnion at the feed end of the mill and taking its feed from a small hopper connected with the main feed bin. Another advantage is that the feed, being under positive control, can be regulated to meet requirements. The arrangement of this feeder, features of which are patented by the Hardinge company, is shown in the accompanying sketch.

Another difficulty arose from the accumulation of water vapor within the mill. The effect was to dampen the charge and retard materially the rate of grinding. This was overcome by the simple expedient of building a tight box around the discharge end and connecting it to the atmosphere by means of an 8-in. galvanized-iron pipe leading through the roof of the building. This created sufficient draft to draw off the warm water vapor without carrying with it an appreciable quantity of dust. The contrivance, originated by Mr. Smith, has solved that difficulty. Mr. Smith has likewise demonstrated, as a result of experimentation, that the maximum grinding is accomplished by means of feeding 1-in. chilled cast-iron balls; larger balls are not so efficient, according to his experience. The consumption of balls and of liners per ton of material ground is naturally small. The practice is to keep the ball charge just below the center of the mill, which is run at 27 r.p.m.

One great advantage of the ball mill is the regularity with which it operates and the small amount of care that it requires. If it is oiled occasionally, it goes along doing its work day after day without attention either from the mill man or the mechanic who is in charge of repairs.

However, the principal feature of the Stockertown plant is the use of air-separating equipment. Efficiency in any grinding operation, whether wet or dry, depends upon the principle of separating and removing from the aggregate the particles that have been reduced to the desired size, thereby giving the grinding machine a chance to work on the remaining oversize particles, instead of wasting its energy on those already finished. For this obvious reason "batch" grinding, generally speaking, is utterly inefficient. A step in advance of batch grinding is the sequence of operations in which the partly ground material is removed from the machine and is sized by passing through a wire screen or, in the case of very fine material, a bolt made of cloth. The oversized portion is returned to the mill for further grinding. If the operation is a wet one, classification in water can be, and generally is, substituted for screening; if the process is a dry one, separation by means of currents of air generally should be substituted. This fact, unfortunately, has not been accepted as widely and as intelligently as it ought to be by people who are engaged in grinding various minerals. This is one reason for my feeling justified in describing the air-



Typical arrangement of air-sizing equipment

separating equipment at the Kelly plant in some detail, even though it presents no novel features to distinguish it from that installed in a great many other plants.

The difficulties of bolting through a medium of fine mesh are several: (1) It is difficult to keep the screen up to normal capacity when the material is somewhat damp. Either it must be dried thoroughly beforehand, or an exorbitant investment in screening equipment must be made. (2) Holes will wear in the screen, and oversize material will get into the product, whereas it is often vital that there be no oversize. This entails double screening, or the replacement of screens before they are nearly worn out, with consequent increase in operating cost. The above are typical troubles experienced by operators; their existence is the reason why nothing but air separation is used in the Kelly plant today.

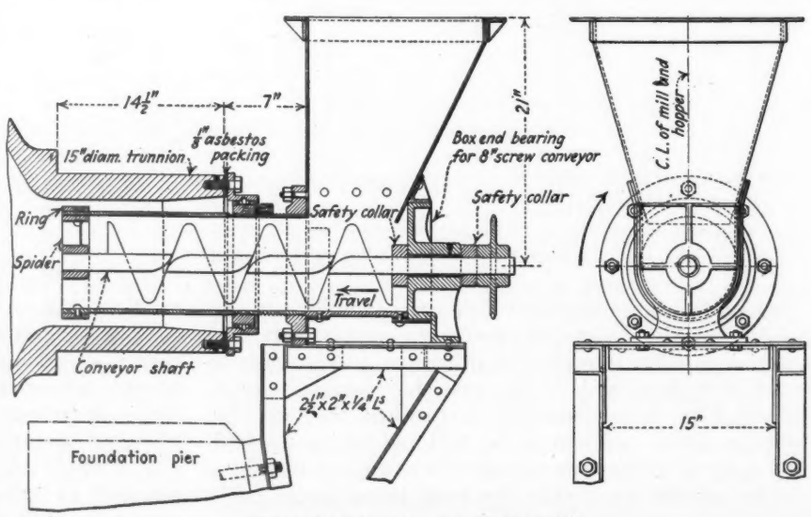
The principle of air separation is this: If a current of air carrying solid particles of various sizes is given a whirling or cyclonic motion, centrifugal force will pull the larger particles to the periphery of the "whirl" with a greater force than the finer ones. This is the physical law upon which the operation of all air separators depends. The apparatus that has been designed by the Raymond Impact Pulverizer Co. to accomplish the result consists of an "exhausting fan," a "vacuum separator," and a "cyclone collector," with the necessary piping, and a feeding device. These are shown in the accompanying illustration; likewise, an interior view of the "vacuum separator" is reproduced.

The suction from the fan is applied at the mouth of the small central pipe that extends downward into the separator; but the only available air is that from the outside annular space *through* eight small ports, seven of which are indicated in the illustration. It is clear that the incoming air may be made to take a tangential direction in varying degree according to the setting of the vanes. The purpose of these adjustable vanes is to regulate the fineness of the particles that will be collected. Suppose that a particle of mineral is sucked into the inner cone through a port hole. It is subject to two forces: (1) that of centrifugal action tending to throw it to the outside of the inner cone, whence it will fall to the bottom and be discharged, and (2) the suction which tends to pull it upward through the central pipe to the fan. If the particle is small enough and light enough, the second force will prevail and the particle will go to the fan. The more nearly the vanes are pointed in a radial direction, the larger will be the particles that are sucked out by the fan; whereas, on the other hand, if the vanes steer the current long the tangent, the tendency will be for only the smallest particle to enter the fan. It is possible to adjust them so that only material as fine as 350 mesh will be carried through the fan.

The purpose of the "cyclone" collector is to relieve the air of its burden of fine mineral particles. This device also depends on centrifugal action. It will be noted that the influent pipe is pointed tangentially; at the same time the suction in the effluent pipe, induced by the circulating air currents, is not great enough to carry many of the particles with it. They accordingly drop and collect in the cone as a finished product. The air, relieved of its burden, returns and again gathers a load to carry through the vacuum separator.

Oversize Returns for Regrinding

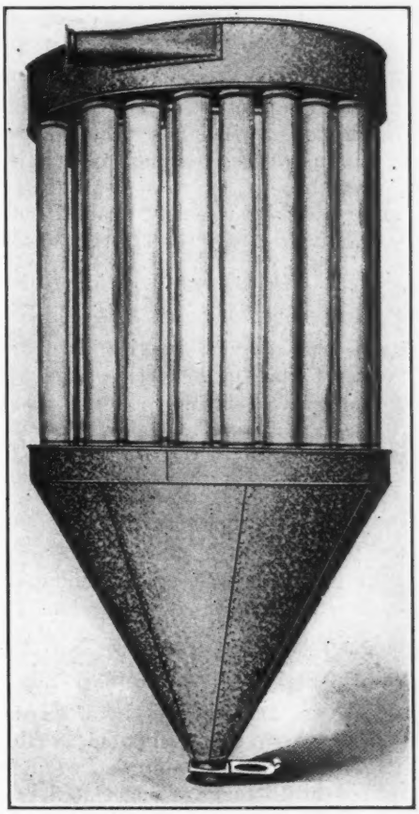
The oversize particles from the separator accumulate in the bottom of the inner cone, whence they are drawn to return to the grinding mill for further reduction.



Patented feeder for ball mill

This accumulation both of fine and oversize serves the purpose of sealing the outlet spouts so that no air enters through them. Some excess air, however, enters through the feeder from the ground-ore bin, (in spite of a patented feeding device, designed to minimize it), and there is a small surplus, laden with some dust that must be disposed of. For this purpose a tubular dust collector is used. This consists of a horizontal disk-shaped iron header placed above a conical hopper and connected to it by means of a series of cloth tubes similar to, but smaller than, the bags used for filtering smelter smoke. The excess air passes through the bags, leaving its burden behind it. At the Stockertown plant 20 to 25 lb. of dust per ton of material ground is caught in a collector consisting of seventy-six bags, 6-in. in diameter and 10 ft. long. This is very fine material, and much of it is used to make high-grade products.

An interesting point is the automatic regulation of the size of the finished product after the vanes have once been set. Any fluctuation in the rate of feed or in the speed of the fan does not alter the maximum size of the fine product. The reason for this is that the centrifugal force applied depends upon the velocity of

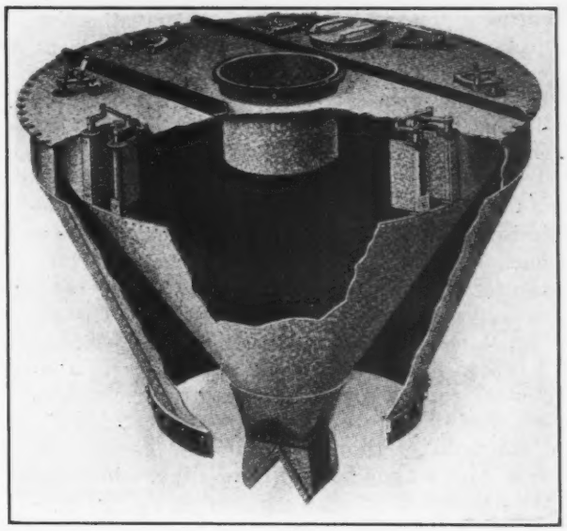


Tubular collector

the "cyclonic" action and that the latter depends upon the operation of the fan, which likewise regulates the strength of the suction. Accordingly, a constant balance always exists that is altered only by changing the direction of the vanes at the port holes.

The installations of Raymond equipment at Stockertown are designated as a "6-ft. separating plant." The efficiency of the separation is indicated by the fact that only 5 per cent of the material returned as oversize is in reality so fine that it should have gone with the finished product. The capacity of a unit, including grinding and separating equipment, varies widely, depending, of course, upon the character of the material or mixture being ground and upon the maximum particle-size allowed in the product. The range is from ½ to 1¼ tons per hour, the nominal capacity of the plant on three-shift operation being about sixty tons per day. The separators could efficiently handle more material than can be crushed.

The accompanying drawing shows the plan of the ground floor of the mill proper, and a section of the whole plant. The compactness of the design is appar-



"Vacuum separator" with interior exposed

ent. The tracks of the Easton Northern R.R. pass within 40 ft. of the plant and the company owns a 400-ft. side track, which facilitates loading and unloading.

There are a number of reasons for building the plant at Stockertown instead of at the seaboard, which might to some engineers appear to be preferable as a location for such an enterprise. Electric power is comparatively cheap. This comes from the Pennsylvania Power Co., and costs slightly more than 1½c. per kw.-hr., the excess depending upon the rate of consumption. The current is generated at Hauto, Pa., where anthracite screenings and dust are used as fuel in steam-electric plants. These are situated at the mines—an important factor in economical power generation. At Stockertown transportation facilities are excellent, a number of trunk lines passing through Easton. Another favorable condition is a supply of competent and reliable workmen, at reasonable wages. The base rate of the present time is 40c. per hour. There are no unions; and strikes do not interfere with operations. One other factor is the comparatively small investment in real estate and the low taxes.

Mica Grinding Methods Improved

Mica grinding methods now in use are for the most part much more efficient and speedy than those formerly used, according to Oliver Bowles, mineral technologist of the U. S. Bureau of Mines. Both wet and dry grinding methods are employed. Most mica used for decorative purposes or as a pigment is ground wet, for it is claimed that dry grinding destroys the luster. Information now available indicates that the dry grinding methods are in general more rapid and less costly.

Drill Sampling of Dredge Ground

Responsibility of the Driller — Difference Between Volume of Sample and of Gravel in Place — Experimental Determination of an Arbitrary Factor — Drill Results Have Generally Been Low

By R. T. Hancock

IN THE ARTICLES by Charles W. Gardner and R. G. Smith which appeared in the *Engineering and Mining Journal* late in 1921, the treatment of the subject of drilling results and dredging returns was mainly directed to showing that responsibility for discrepancies between drilling and dredging results might be divided between the drill and the dredge. Roughly summarizing their papers, the former writer considered that, with a drill factor mathematically derived from the diameter of the drill, the result of drilling will indicate within reasonable limits the gold content of the ground. The last-named writer considered that discrepancies were more frequently due to low recoveries in dredging than is generally believed. The former, quoting James W. Neill, says, "If the driller keeps his drill behind his shoe, and sees that he gets a correct amount of core, there should be little question of the correctness of a *large general average*. . . ." And that statement, I think, sums up the general opinion, familiar to most engineers, "If results are low, blame it on the driller."

Arbitrary Expansion Factor Questionable

An aspect of drilling which I have never seen discussed may be illustrated from an experience of my own. The drill used, while not an Empire or Banka, was somewhat similar in type; the casing was driven by blows of a block of timber suspended from a tripod, and was revolved only in very tight ground. Casing was driven a foot at a time, and cleaned up by the sand pump, which was the usual tubular arrangement with a chamfered shoe and a ball valve. Three pumpings cleaned up the pipe, and the number was kept to this. The pumped gravel, carrying a good deal of slime, was settled in a cylindrical can and the settled volume determined. An arbitrary expansion factor was used for converting the volume of the settled gravel into that of the same gravel in place. The accuracy of such a proceeding was questionable, and therefore steps were taken to determine the actual weight of the gravel pumped, as compared with the ascertained weight of a cubic yard of such gravel in place—that is, including the water filling the interstices.

Weight of Gravel Pumped Compared With Weight of Gravel in Place

To determine this, a bucket was weighed; it was filled with a measured volume of water to a hook gage and weighed again; then it was emptied and "filled" with a sample of freshly dug gravel, from the bottom of a pit, sunk in typical gravel to a depth just above water level, so that the sample should be saturated. Water was added to the sample in the bucket until its level reached the hook gage, and the amount of added water was measured. The weight of the bucket as now filled with the sample and water was then carefully ascertained.

Using the symbols indicated, the results of a series of tests are shown in the table.

A = Weight of bucket.
B = Volume of water required to fill bucket to gage.
C = Weight of bucket filled with water to gage.
D = Net weight of sample (i.e., less weight of bucket.)
E = Volume of sample (B minus volume of water required to fill to gage.)
F = Net weight of sample plus water to gage (i.e. less weight of bucket.)

TABLE SHOWING DATA FROM TESTS.

						Specific Gravities		
A	B	C	D	E	F	$\frac{D}{62.4xE}$	$\frac{D+C-}{F-4}$	$\frac{D+C-}{F-4.5}$
Lb.	Cu.Ft.	Lb.	Lb.	Cu.Ft.	Lb.			
4.5	.2937	23.0	22.5	.1359	32.6	2.64	2.53	2.56
4.5	.2937	23.0	25.8	.1629	34.3	2.54	2.46	2.58
4.5	.2937	23.0	26.1	.1649	34.8	2.52	2.66	2.80
4.5	.2937	23.0	26.8	.1652	35.1	2.60	2.50	2.63
4.5	.2937	23.0	27.9	.1762	35.5	2.54	2.45	2.56
4.5	.2937	23.0	29.0	.1831	36.3	2.53	2.48	2.59
4.5	.2937	23.0	30.1	.1871	37.1	2.57	2.51	2.68
Averages						2.56	2.51	2.63

With the above data, there are several ways in which the weight of a cubic foot or a cubic yard can be determined. The method of measuring the quantity of water added was untrustworthy, owing to imperfection of apparatus available. The most satisfactory result appeared to be one derived solely from D and F. Plotting these on squared paper the relation observed was:

$$F = 0.6D + 19 = \frac{D(S.G. - 1)}{S.G.} + \frac{47.5}{S.G.} = \frac{D(1.5)}{2.5} + \frac{47.5}{2.5}$$

Accordingly, the specific gravity is 2.5; the net weight of water filling the bucket to gage, 19 lb.; and the quantity of gravel which would fill the bucket to gage and leave no room for water, 47.5 lb. Actual values of F found as against those computed as above were:

F	32.6	34.3	34.8	35.1	35.5	36.3	37.1
F^1	32.50	34.48	34.66	35.08	35.74	36.40	37.08

As the weighing scale was only graduated to half-pounds, closer readings are by estimation.

Proposed Method for Determining Weight of Gravel in Place

It will be observed that the weight of water required to fill the bucket to gage as computed (19 lb.) differs from that obtained by actual weighing (18.5 lb.). The volume required to fill to gage, calculated from a special weighing, differs from that which would be given by 19 or 18.5 lb., though it is close to the latter. There are grounds for a suspicion that the spring balance employed did not record correctly until a pound or so of initial compression was applied. Strict agreement between individual samples is not to be expected; they were small, and a few quartz pebbles above or below the general average would affect the specific gravity.

My conclusion is that the specific gravity or weight per cu. yd. of gravel in place can best be determined by weighing dug samples in a bucket against the weight obtained when water is added to fill the bucket to a definite mark. Gross weights, including the bucket,

can be used; the only influence of the bucket-weight is to affect the value of the constant expressing the weight of the bucket, filled with gravel itself, to gage.

Having decided that a specific gravity of 2.5 is the most reliable figure, this is equivalent to 156 lb. per cu.ft. In sampling, the gravel pumped from each foot of drive is settled in a bucket (a pinch of alum helps), decanted, and the water level made up to hook gage. The weight of water required to fill the bucket to gage without any gravel must be previously determined. The addition of 2.5 lb. of gravel will replace 1 lb. of water, so that for every pound which the bucket, with sample and water to gage, weighs in excess of the weight of the bucket with water to gage, 0.01068 cu.ft. of gravel in place has entered the bucket.

$$0.01068 = \frac{1}{62.4\ (2.5—1)}$$

Measuring cores in this way, it was found that the volume of gravel extracted by pumping out at each foot of drive was only about a third of the volume of a cylinder of such gravel 1 ft. in length, and of a diameter equal to the external diameter of the pipe.

This value, one-third, was by no means constant from foot to foot, but represented a general average. The height to which the gravel rose inside the pipe after this had been driven a foot varied considerably. Usually at the bottom of the hole the volume extracted corresponded with what would be derived from the external diameter of the pipe, or approximately so. At higher horizons it was much less, as a rule. The volume of core extracted did not correspond uniformly with the height to which gravel rose inside the pipe after driving a foot; when this rise was considerable, a small volume of core was recovered by the pump, as was also the case when only a small rise was observed.

Maximum volumes per foot of drive were pumped from mean heights of rise. The reasons are fairly obvious. It happened that valuable minerals were not concentrated in the layer of gravel on bedrock, but the markedly different volume of core obtained therefrom would have vitiated results if this had been the case, and the average factor had been applied, as a full core would have been obtained from the richest ground.

Arbitrary Value May Be Erroneous

It is most dangerous to advise that a "correct amount of core" should be obtained. What is a "correct amount of core"? That it is not a volume equal to that of the driven pipe is quite generally held, but there are many who would hold it to be that of the internal diameter. One contributor to your columns, not one of those earlier named, says boldly, "Whenever I work with Empire drills, I always use the factor 385, which is found by taking the inside diameter of the cutting shoe instead of the outside, from which the factor 239 was evidently derived." This is typical practice, where no attempt to measure the weight or volume of the core extracted is made. In other cases, the core extracted is measured in a box, either by settling it as much as possible and using perhaps an imaginary expansion factor, or by squeezing the water out of it and measuring its volume in a state as near that in which it originally existed as can be obtained.

So much for core measurement; if the matter ended there, and the core were a fair sample of the gravel, there would be nothing further to add, but it is obvious to me that the sample obtained is never a fair one. It contains far less coarse gravel, and much more fine, than it should, because, in gravel at all free, the larger pebbles are driven aside by the shoe, and, these being barren, the fine gravel and silt which make up the sample are enriched to an unknown degree. To determine the relation here, it is necessary to sink shafts over bore holes, and compare results. For this purpose the data quoted by R. G. Smith on p. 814 of the *Journal* of Nov. 19, 1921, would serve if we were told the actual weights or volumes extracted from the bore holes, instead of the bare statement that a factor of 0.30 was used. This really conveys nothing at all; it proved to be a conservative factor, and if the ascertained volume of the extracted cores had proved to be 80 per cent of that corresponding to the external diameter of the pipe (assuming the factor for such pipe to be theoretically 0.27), the multiplication of the values by 1.25 would have produced correspondence on an average between bore holes and shafts. But it is much more likely that the cores were less than 80 per cent, and that they had undergone a corresponding enrichment.

Fortunately for the profession, the really low percentage recovery of core is generally overlooked, and the countervailing influence of enrichment likewise, with the general result that drill figures are on the right side—fortunately, too, for the dredge builders, who can triumphantly point to high recoveries. But they may often lose business through payable ground being turned down.

Oregon Mines Moderately Busy

After a short shut-down to install pumping machinery, the Copper Syndicate mine, at Homestead, Ore., has resumed work, according to the Geological Survey. The Imperial mill, in Cable Cove district, has also resumed operations. The Iron Dyke, usually the most productive deep mine in Oregon, has been inactive for some time. Arrangements are being made to rehabilitate the old smelting plant at Sumpter, which has been inactive for many years. Placer work around Susanville, in Grant County, has been hampered this season by large accumulations of snow in the hills. The Utah & Oregon Gold Mines Co., operating Homestake mine No. 2, at Prairie City, is running a tunnel and doing some repair work. The Beaver Gold Mining Co., lessee of the Buffalo-Monitor mine, at Granite, has been shipping to the mill this year a small quantity of crude sorted ore.

The mill at the Magnolia mine, at Granite, has been reconstructed and a cyanide plant is being added. The Pacific Placer Co., at Applegate, Jackson County, is operating its mine at the full capacity of its hydraulic plant and water supply. Owing to the freezing of the water at the intake of the ditches in the mountains the company could not begin washing gravel until April 1 this year, but since then the supply of water has been larger than ever before. At the Sterling mine, Jacksonville, there was water for work in the spring only, but the production continues at the same rate as for the last five years. At the Afterthought mine, at Applegate, a thorough system of development is in operation this summer, continuing that of last year.

On the Hammersley mine, at Placer, Josephine County, a tunnel is being driven to cut the vein at a distance of 200 feet. Most of the owners of the smaller mines in Josephine County have resumed work.

THE PETROLEUM INDUSTRY

The Rumanian Petroleum Industry During the First Quarter of 1922

Output Improves Compared with 1921 Despite Power Shortage and Difficulties of Transportation—Third Pipe Line Proposed

BY ANDRE SURNY DE BONNIER

THE PRODUCTION of petroleum obtained in Rumania since the beginning of 1922 is relatively satisfactory, and marks a considerable improvement over the corresponding months of 1921, as shown by the following figures:

Month	Production in Metric Tons 1921	1922
January	97,883	102,342
February	82,724	100,844
March	93,165	115,963
Total	273,772	319,149

The monthly average production of 106,383 tons is not materially greater than the tonnage produced during each of the last three months of 1921, but the maintenance of the production during the worst months of the winter is in itself encouraging, and the production for March was the largest since the return of the national authorities on Rumanian soil. Nevertheless, if it had not been for the unusually high percentage of flowing wells in the oil fields of Baicoi and Moreni, these productions could never have been reached. The causes of disturbance, which I have set forth in preceding correspondence[1], are just as exacting as before. The electric current on which operators depend for power was cut off or reduced many times during the months under review. It is estimated that production, on account of these accidents, was curtailed from 20 to 30 per cent during January and February. No amelioration in electrical service can be expected until the new battery of boilers, installed at the electrical plant of Campina, is under pressure, and until the power-house built jointly by Electrica and the Steaua Romana, at Baicoi Floreshti, is in operation. In fact, the capacity of the present power stations is so much below requirements that no well now being drilled is authorized to use electrical power until July or August next. The oil men have to rely on gas, gasoline, or steam engines to produce the necessary power.

Means of transport are still insufficient, and the situation becomes worse every day; more tank cars are put aside for repairs than can be repaired in the same period of time. A great burden seems to devolve upon the railroad authorities. From a report presented to the Minister of Industry and Commerce by Const. Osciceanu, general manager of the Steaua Romana, on behalf of the oil-producing companies of Rumania, the following figures, which show the difficulties of the situation, have been taken:

In May, 1921, there were in Rumania 5,362 tank cars, of which 2,193 were state property and 1,369 belonged to private concerns. All but thirty-seven of these cars last mentioned were requisitioned by the state. They were used in the following manner: 755 for the needs of the state or for internal consumption; 233 for the export business of the oil companies; 544, not in service, being used as water tanks in railroad stations, or in repairs. At the beginning of December, only 2,223 cars were in use, 1,990 for the state's organization and 233 for the oil concerns.

Only one fact, in matter of transportation, is to be noted favorably. The operation of trains between Constanza and the interior of Rumania has been reestablished. The traffic schedule is now actually three to four trains daily, and 900 to 1,200 tons of petroleum products could be shipped to Constanza every twenty-four hours if railroad material was available.

Some time ago the arrival of numerous tank cars from central European states, to be filled with oil products for these states, was expected, but these hopes did not materialize to any great extent, because the foreign concerns interested are afraid that their cars would be taken over on some pretext by the Rumanian government or used for some other than their own interest. The only way out of this difficulty is for more cars to be repaired every twenty-four hours. To help the government accomplish this, the companies have made an offer to the "Chemins de fer roumains" to repair the tank cars in their own repair shops or to advance the money to have them put in order in mechanical plants. Everyone agrees that something must be done, and quickly, but recent experiences are too unfavorable to permit great confidence in the possibilities of a rapid amelioration of present conditions.

Transport by pipe lines is not any better, 550 tons only being transferred daily to Constanza. Losses in transportation, which were 2 per cent before the war, are reaching 3½ to 4 per cent today.

In answer to the numerous criticisms of which his administration is the object, the director of the Rumanian pipe-lines service is expressing his regret that his organization is not autonomous. If it were, it could supply its needs and make a profit. The revenues of the pipe lines are part of the state revenue, and because the government is indebted about 200,000,000 lei[2] to the oil companies, these companies are not willing to pay the pipe-line administration the 40,000,000 lei they owe. All that the oil companies are willing to do is to give just enough money to pay the laborers and make repairs.

As regards the building of a third pipe line, however, between Baicoi and Giurgiu, the oil men have shown their readiness to stand the expense. In fact, this work ought to have been started a long time ago, the pipe required having been lying on the ground unprotected for the last two years. The oil concerns agree also to buy the ground necessary, equipment for the erection of tanks in Giurgiu, to pay for the repair of the tracks between Borcea and Constanza, and to supply the money needed for some other works of minor importance.

In Constanza, the great petroleum harbor of Rumania,

[1] *Engineering and Mining Journal*, March 4, 1922.

[2] Normally 19½c. Rumanian currency is now greatly depreciated.

the thirteen 3,000-cu.m. tanks that were destroyed during the war will be rebuilt by their pre-war owners when it is possible to make satisfactory arrangements.

The cause which is most responsible for the slow recuperation of the Rumanian petroleum industry is the continual injection of politics into business.

Many are the occurrences where the government has interfered. Since the close of the war, it has paralyzed, prohibited, delayed, or monopolized the export business for its own profit. It has obliged the producers to sell to it, at very low prices, a large quantity of petroleum, which it turned over to foreign buyers at a substantial profit. It has monopolized for its own needs all the foreign money paid to oil concerns as a result of sales of petroleum products. It has taxed the goods exported and it has regulated the prices to be paid in Rumania for petroleum, prices which are much below the producing costs.

The inevitable result has been that the companies have had little incentive to increase production. Many refineries which have no producing fields have been obliged to close because the prices paid for refined products are not in equitable relation with the prices paid for crude oil.

One of the last actions (or rather inactions) of the government is the subject of much criticism. Today, the public officials are holding up all decisions concerning requests for concessions or transactions in oil lands. There is much talk about a law which would confiscate the subsoil rights now belonging to the owner of the surface.

If it was not for political interference, the export business would be much larger, to the greater benefit of the oil industry, and also of the country. In the following table are given figures published by the General Director of Commerce for the exportation of petroleum during the first quarter of 1922:

RUMANIAN PETROLEUM EXPORTS IN METRIC TONS IN FIRST QUARTER OF 1922

Months	Crude Oil		Benzine		Kerosene		Gas Oil		Mineral Oils		Total	
	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922
January	.....	.....	1,787	11,975	3,310	16,181	2,025	333	1,761	565	8,883	29,054
February	4,300	.....	3,811	6,233	10,594	12,242	732	912	2,230	381	21,667	19,769
March	3,105	.....	6,699	12,893	13,017	26,996	2,796	3,337	2,111	1,017	27,728	44,243
Total	7,405	.....	12,297	31,101	26,921	55,419	5,553	4,582	6,102	1,964	58,278	93,066

Although the improvement made over the corresponding period of 1921 is important (60 per cent), the results are far from satisfactory, if compared to the export business made during the last three months of 1921, when the total exported was 176,599 tons. Furthermore, one must remember that the prices for oil at the beginning of 1921 were unfavorable for exploitations, and that business was then very quiet. It was only at the end of the year that the markets were more active.

It is interesting to observe that during the first three months of 1921, Rumanian oil was not bought by those countries of Central Europe that would be the natural customers. Indeed, the export business done with Czechoslovakia, Austria, and Hungary was small, and the transactions with Italy, France, Turkey, and Egypt were important, as shown in the following table:

Importing Country	(Metric Tons) 1921	1922	Importing Country	(Metric Tons) 1921	1922
Italy	9,546	22,710	Germany	.....	1,198
France	3,711	21,195	Czechoslovakia	10,177	611
Turkey	4,543	15,892	Salonica	.....	359
England	7,469	7,264	Smyrna	4,637	133
Bulgaria	6,741	5,181	Ships	984	.....
Greece	49	2,471	Miscellaneous	8	.....
Jugoslavia	1,529	2,455			
Austria	5,259	1,925	Total	58,278	93,069
Hungary	3,633	1,414			

Automatic Bailer for Oil Recovery

AN ELECTRICALLY operated automatic bailer for the raising of oil from wells is now being used on the property of the Hibbard Petroleum Co. in the Kern River oil field, Kern County, Cal. The wells in this portion of the field, Sec. 25, T. 28 S., R. 27 E., M. D. B. and M., have to be pulled and cleaned every few days, as sand is continually heaving into them. This causes considerable loss of time and production. It was to obviate these losses that the idea of continuous bailing was conceived. The automatic bailer was designed by Jack Hibbard, superintendent, and all of the equipment was supplied by a local firm. The following details are as reported to the California State Mining Bureau by E. Huguenin:

The bailer, as shown in Fig. 1, is a scow-bottom sand pump. A nipple of slightly larger diameter than the bailer is screwed on the bottom. A spring, coiled around the bailer, rests upon the shoulders of this nipple and supports a sleeve of ½ in. larger diameter than the bailer. The sleeve covers two openings through which the contents of the bailer is discharged. Upon emerging from the well, the bailer passes through an iron cage (see Fig. 2), which is mounted on the casing-head, being held in place by a sleeve 2 ft. long. The cage is made of three 2-in. angle irons, 8 ft. long, welded at top and bottom to pieces of pipe sufficiently large in diameter to allow the bailer to pass through. Attached to the cage is a heavy circular iron weight (see Fig. 2), which is free to move up and down the length of the angle irons. It has a central opening of the same diameter as the bailer. When the sleeve on the bailer comes in contact with this weight, the sleeve is forced downward, compressing the spring and allowing the discharge to take place, as shown in Fig. 3.

The bailer used is 4 in. in diameter and 50 ft. long, having a capacity of approximately one barrel. The oil string in the well on which the bailer is operating is 6⅝-in. casing. At first a 5-in. bailer of the same capacity was used, but the friction between the bailer and oil string was so great as to cause overloading of the motor.

The electrical equipment which operates the bailer is similar to that which is used in the operation of automatic elevators. It is mounted on a motor truck with the sand-line reel and connecting gear. The entire assembly can, therefore, be moved from well to well by making a few simple changes. Power is supplied by a 30-hp. motor, equipped with a solenoid brake, so that when not in motion the brake is set, holding the main drive-shaft stationary. The motor drives a shaft on which a worm gear is set, with a ratio of 30 to 1, equipped with sprockets, which in turn drive the sand reel. Bolted to the sprocket shaft is a long screw 1 in. in diameter, as shown in Fig. 4, which controls the regulating mechanism. This mechanism consists of two sets of three switches each, with traveling carriage mounted on the screw. Its operation is described below.

The cycle of operation is as follows: Power is turned into the operating mechanism by a main switch. The

current is delayed from reaching a 440-v. switch, which controls the 30-hp. motor, by an oil delay switch. This delay switch makes a contact with the motor, starting it in direct action—i.e., on the down side, so that the bailer descends. As the bailer descends, the carriage (see *C*, Fig. 4) mounted on the screw travels toward three small switches (*X*, Fig. 4). The block which supports the switches is set in position by a setscrew on a small I-beam, parallel to and beneath the long screw. The position of this switch block determines the depth to which the bailer is to be lowered. A movement of one inch of the carriage is equivalent to a 73-ft. movement of the bailer.

When the carriage reaches the first or nearest of the three small switches, it throws the grids out, slackening the motion of the motor. The screw continues to revolve until the carriage reaches the second switch, which reverses the motor. The current is delayed by the oil delay switch, giving the bailer time to fill. The third small switch on the block is a safety break switch to break the current, should anything go wrong with the second switch. As the bailer ascends, the carriage travels away from the switch block. A small spring is attached to each switch on the block, which pulls it back into position after being released by the carriage.

On the opposite side of the screw are three push switches, shown at *P*, Fig. 4. The action of these switches is controlled by a small steel rod attached to the carriage. As the carriage nears the head of the screw, the rod throws the switches successively into place, the action of each being similar to that of the three small block switches. The interval of rest, in which the bailer discharges, is controlled by the oil delay switch and can be regulated for any period that may be desired.

When the bailer discharges, its contents are caught in a covered cylindrical tank. The tank now in use is 12 ft. in height and 3 ft. in diameter. It is placed over the casing head, having central openings in the top and bottom only sufficiently large to allow the bailer to pass out at the top and to fit closely over the casing head. A false bottom is set at an angle of 30 deg. in the tank, the lower side being 2 ft. below the top of the casing head or bottom of the cage. A 12x16-in. opening at the base of the tank allows the fluid to flow through a trough to the sump. When the bailer is in the discharge position it is practically impossible for the fluid to re-enter the well, as the closed bottom of the bailer remains at the casing head.

The cage allows the bailer to move 8 ft. after striking the weight, which is more than ample space in which to stop. As now regulated, the bailer stops in less than 2 ft., after encountering the weight. Should the bailer fail to stop, it would simply raise the cage out of the casing head, as the latter is not attached to it. A safety switch is placed at the casing head, and the pulling of the cage automatically throws off the main switch, stopping all motion.

A complete trip of the bailer is made in seven and one-half minutes when bailing from a depth of about 1,000 ft. The bailer travels at a rate of 300 ft. per minute, the periods of rest being one-quarter minute at bottom and one-half minute at top.

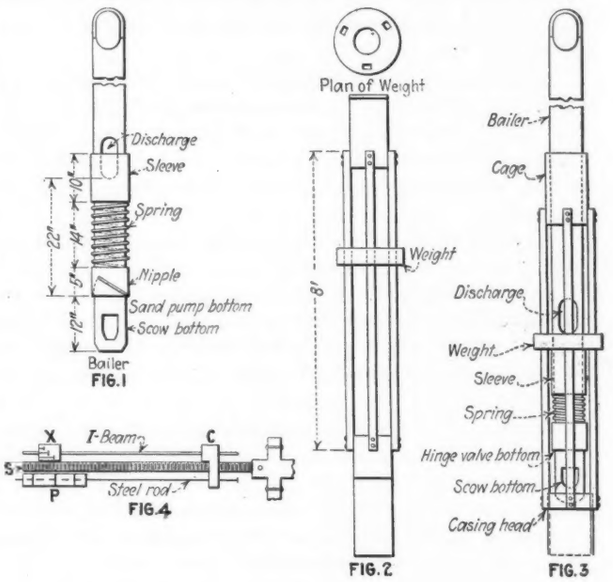
A slack line switch has been placed at the sand reel. If the cable becomes slack, due to sudden bridging of sand in the well, the switch is thrown by a wire stretched just below the cable, close to the reel. The switch reverses the action and the bailer ascends. By such action it is hoped to clean out the well if it suddenly bridges.

No figures are available on the cost of operating the automatic bailer, but the owners report that the electrical power necessary to operate is about the same as that required for an individual motor pump. The initial cost of equipment, however, is higher.

The principal advantages of the automatic bailer are:

1. By continuous bailing the well is kept clean and the expense of pulling and replacing tubing, rods and pumps is avoided.

2. The bailing has a swabbing effect on the well which tends to keep the perforations open. At this particular well, production is reported to have increased



Details of automatic bailer for oil recovery

from a daily average of 10 to 12 bbl., when pumped in the ordinary way, to 50 to 60 bbl. as now bailed.

The disadvantages are:

1. Very fine adjustments required in the electrical operations.

2. The bearings on the main drive shaft have a tendency to overheat during long continuous operation.

The automatic bailer has been used only on comparatively shallow wells, less than 1,200 ft. deep. Its use would be limited by the length of time required to make a complete trip. Experiments conducted by Mr. Hibbard show that it is not practicable to increase the speed of the bailer beyond 300 ft. per minute, so that for deep wells of large production it would not be feasible.

Ruling in Mexican Court Fails to Satisfy Hughes

The *New York Times* of Aug. 11 stated, with reference to the Mexican petroleum situation, that the *amparo* cases failed to satisfy the Secretary of State, Mr. Hughes. According to Secretary Hughes, it was said, Mexican court decisions do not extend to lands undeveloped before 1917, and another act of the Congress at Mexico City is needed. Further action on the part of the Mexican government is necessary before it can be recognized.

New Books

The Story of Modern Science

Prof. J. Arthur Thomson's New "Outline" of Great Educational Value and Importance.

Outline of Science. Edited by J. Arthur Thomson. New York. G. P. Putnam's Sons. Vol. I, 296 pp.; illustrated. $4.50.

The purpose of this book is to provide the intelligent student-citizen, otherwise called "the man in the street," with a "bunch of intellectual keys" with which he may open the doors of common knowledge that hitherto have been closed to him, partly because he could obtain no glimpse of the treasures behind them, and partly because, in consequence of an unnecessary display of technicalities, the portals appeared forbidding. Each article is supplemented by a bibliography; each is meant "to be an invitation to an intellectual adventure," the list of books given to serve as finger posts to indicate the direction that subsequent journeys may take.

The editor of this fascinating treatise has proved conclusively that technical and scientific terminology can be reduced to insignificant proportions without involving a sacrifice of accuracy. The book is commendably free from excursions into fiction, such as mar so many of the so-called popular scientific treatises. The publication of the first volume of the series marks a real attempt—one of the first—to present scientific facts in language that can be understood by all literate persons. The result is truly an outline of science—an outline that is as educative as it is interesting.

The story of modern science, as the editor of the series maintains in the introduction, is one of which men may well be proud. The world has been made more vital—"there has been a passage from the static to the dynamic." The new revelations of the composition of matter have shown that even dust can have a complexity and an activity heretofore unimagined. The new theory of the atom within the atom "amounts to a new conception of the universe." The discovery of the "hormones," or chemical messengers, produced by the ductless glands, and their function in regulating man's internal economy, have changed the general conception of physiological processes.

A book such as this is particularly valuable because it encourages, by a process that is agreeable as well as educative, the development of the scientific manner of reasoning—the scientific habit of mind. This attitude—toward life, progress, civilization—should be welcomed by all of us; but unfortunately there are those who refuse steadfastly to distinguish fact from fable, current rumor from logical reasoning. Thus a prominent politician was reported to have protested recently against the idea that we are all descended from apes, in this manner contributing his share toward the withholding of enlightenment from several million people. It matters little that no scientist has ever pretended or professed that man is descended from an ape; those in the unprogressive group refuse to adopt the scientific habit of mind; each presupposes what is not so, for the pleasure, apparently, of performing to the gallery. What an outburst would be occasioned among theologians if a scientist were to proclaim from the housetops that it was illogical to expect any sane man to believe that Jonah swallowed the whale! What a following he could obtain among hoi polloi were he to cast aside the scientific habit of accuracy and prey on the ignorance of the masses, as do some of the objectors to Darwin's theory of evolution.

In the book under review a quiet assurance and an unobtrusive positivism characterize each section. The findings and conclusions are based on a multitude of confirmatory facts, all of which are interesting; all dovetail, as it were, the one into the other. The patient researches carried on through many decades of unselfish endeavor and quiet groping for the truth have been crystallized in an array of evidence that must be convincing to all who will but admit that the world has progressed at an extraordinary rate since science became the inspiration of our minds and the profit of our industries. An unvarnished account of this great adventure, therefore, should appeal to all, especially to those who profess no knowledge of pure science. To such it will be of inestimable service, inculcating a wholesome respect for the truism that science is built on impartial testimony, on facts and actualities, and on circumstantial evidence of a convincing nature.

The scientific habit of mind—the observance of every detail and the faithful representation of all the facts—is worth cultivating. The world may owe much to the pure science of Faraday, for instance, whose researches on electromagnetic induction presaged an economic development and a material progress that almost baffles description, so rapid have they been in those few recent years that constitute but an infinitesimal fraction of time in the long history of the world; but equally important is the result of the application of the scientific habit of accuracy, such as led Wickham in the early 70's with no idea of ultimate commercial gain to himself or others, to make an accurate drawing of the leaf and fruit of the Para rubber tree that grew in the forests of the Brazil—a simple act that led to the establishment of a vast enterprise in the Eastern tropics and made possible the inception and amazing growth of the automobile industry of the United States.

In style of writing, in arrangement and illustration, the first volume of the "Outline of Science" is excellent. Many scientific and technical writers of comprehensive and what might be termed wide-angle treatises assume the entire authority for what appears between the covers. Professor Thomson, whose scientific acumen and literary experience fit him especially for the task, is content with the title of editor of the series, a bibliography being a feature of every article. This plan is an excellent one; it tends to discourage irresponsible statement and serves to indicate profitable avenues of further enlightenment for those who find themselves more than usually interested in a particular subject. A. W. A.

The second volume has just been published, the third should be out this month, and the fourth, before the end of the year.

Barium and Strontium in Canada. By Hugh S. Spence, Canada Department of Mines, Mines Branch. Pp.100; 6½ x 9¾ in.; 15 plates; 18 figures, Ottawa, 1922.

Three-fourths of the book, Part I, is devoted to barium, and one-fourth, Part II, to strontium. As described in Chapter 1, the Canadian deposits are probably all of the fissure-vein type, the barium originating from the enclosing rocks, whether sedimentary or crystalline. The mode of origin seems to be more definitely determined for the Canadian than for the American deposits. Statistics for the past 36 years show no consistent growth in the Canadian industry, production varying from a few hundred to 4,000 tons per year. In 1920, one grinding mill only was in operation in the country. Either through insufficient grinding, or poor color, the Canadian product has not entered into successful competition with United States barytes. There has been practically no exportation during recent years. The United States barytes industry is summarized from the report of the United States Tariff Commission. In Chapter 2, the barytes mines and occurrences in Canada are described in detail. The most productive mines in Canada at present are those on Cape Breton Island, Nova Scotia. Various other deposits occur in Nova Scotia, particularly in Colchester and Hants Counties. Deposits, some of which show large reserves, are described as occurring in New Brunswick, Ontario, Quebec, and British Columbia. Chapter 3 gives a description of barytes, its composition, properties, method of grinding, bleaching, flow sheets of English and American mills, and a discussion of the various barium products such as lithopone and *blanc fixe*. In Part II, devoted to strontium, it is pointed out that four economic deposits of celestite occur in Canada, all of them in Ontario. The largest and the only producing deposit is near Calabogie, in Renfrew County. The sources and uses of strontium are given briefly. For both its general treatment, and its specific discussion of the Canadian deposits and industry, the bulletin is a valuable addition to non-metallic literature. O. B.

SOCIETIES, ADDRESSES, AND REPORTS

Lead Poisoning at Broken Hill and Miners' Diseases Reported On

New South Wales Commission Suggests Removal to Other Districts of Affected or Susceptible Persons

BY PETER G. TAIT

The Royal Commission appointed by the New South Wales government to enquire into the working conditions of the men employed on the Broken Hill field, particularly on underground work, has presented its report. The Commission found that a condition of pneumoconiosis may arise in the lungs of mine workers as a result of the inhalation of particles of dust. Of the 6,538 mine workers examined, the Commission discovered 373 affected with pneumoconiosis and tuberculosis in various degrees. These conditions of pneumoconiosis render the miner more liable to contract pulmonary tuberculosis. After the infection with tuberculosis the general health fails, impairment of working capacity develops, and clinical signs of pneumoconiosis, complicated with tuberculosis, are present on medical examination. The recommendation of the Commission is that persons affected with pneumoconiosis should leave Broken Hill and take up an occupation elsewhere, preferably in an agricultural or pastoral area.

A complete examination for lead poisoning was carried out in respect of 6,538 persons. Of that number, sixty-one men were found to be suffering from the effects of lead poisoning at the time of their examination. The Commission recommends that these should be excluded from the industry and compensated. It is also suggested that the compensation be varied according as the disablement is temporary, permanent, partial, or total.

Since the absorption of lead is caused by the inhalation of dust containing lead, the Commission states that all steps taken to diminish the presence of dust in the air breathed will lessen the amount of lead taken into the body, and it holds that the conditions of mining set out for the industry in an earlier report will diminish the number of persons affected by lead. The Commission is of opinion that the effect of the poisoning due to lead in this industry should be prevented by removing susceptible persons from exposure to the action of lead.

It is suggested that a board of three medical practitioners, representative of the workers, mine owners, and the Government, be appointed to a medical authority to determine whether a person affected by lead will remain in the industry or be excluded.

The definite opinion is expressed "that the amount of dust present in the air of the mines is so reduced that the quantity of dust taken into the lungs is no longer sufficient to give rise to pneumoconiosis, provided the operation of mining is conducted in a certain specified manner."

The Commission has been at work since 1919 when the tribunal gave an award in favor of a thirty-five-hour week. It was said that this award would hold until the presentation of the final report of the Commission, when if the report was favorable there would be a reversion to the longer week of forty-five hours. Up to the time of writing, however, no announcement has been made by the New South Wales government regarding this point, which is one of considerable importance to the future of Broken Hill.

Utah Metal Mining Institute to Meet at Park City

Invitations Limited to Mining Operating Officials Because of Limited Transportation Facilities

The Utah Metal Mining Institute, which was organized about a year ago, will hold its summer session at Park City, Utah, Aug. 25 and 26. Owing to limited transportation facilities and accommodations, invitations are being sent only to mine operating officials, including department heads, clerks and mining engineers in actual practice. The purpose of the organization, which meets twice yearly, is to afford a permanent medium whereby mining operators can discuss current mining problems and co-operate for the welfare of the industry in the state.

The recent new developments in Park City make it an interesting meeting place. There will be visits to the various mining properties, and a dinner will be held on the evening of Aug. 25.

The members of the executive committee of the Institute are: Carl A. Allen, chairman of the state industrial commission; A. G. Mackenzie, secretary of the Utah Chapter of the American Mining Congress; A. E. Hamilton and A. S. Winthrop, Bingham district; Ernest Gayford, of Salt Lake City, representing the Utah section of the American Institute of Mining and Metallurgical Engineers; William Stewart and H. M. Hartman, of Ophir, representing the state at large; Forrest Mathez and O. N. Friendly, of Park City; A. J. May and William Owens, of the Tintic district.

Motion Pictures on Mining Subjects at Chemical Exposition

Several New Films Included in Program for Event to Be Held in New York Next Month

Fifteen feature films on chemical and allied scientific or industrial subjects have thus far been definitely scheduled on the motion-picture program of the Eighth National Exposition of Chemical Industries which will be held this year during the week of Sept. 11-16 at the Grand Central Palace, New York. The selection includes some of the best industrial films which have ever been taken. "The Story of Sulphur" will be furnished by the U. S. Bureau of Mines and the Texas Gulf Sulphur Co. "The Story of Abrasives" is to be obtained from the Bureau of Mines and the Carborundum Company. Together with the Research Corporation, the Bureau will present "Recovering Values from Fume and Smoke." Other pictures dealing with mining topics are: "Inspiration: One of the World's Great Copper Mines"; "Mexican Petroleum"; "The Story of Heavy Excavating Machinery"; "The Story of Natural Gas"; "Mexican Petroleum"; "The Story of Asbestos"; "Nickel and Copper Mining, Smelting and Refining"; "Prospecting for Gold in Northern Ontario"; and "Assaying for Gold in Northern Ontario."

Penn State Mining School Instructs Nearly 1,000

The School of Mines of the Pennsylvania State College will give instruction to nearly 1,000 students during the coming year, according to an announcement recently made. During the last school year 800 miners and operators were given extension training by the college workers, while nearly 200 other students were in the regular residence courses in mining engineering, mining geology, and metallurgical engineering.

Among the subjects given by the school are ceramics, geology, lithology, palaeontology, stratigraphy, assaying, metallurgy, fuel testing and calorimetry, coking, mineralogy, petrography, mine rescue and first-aid training, mine surveying, mining equipment, design, law, management, ore dressing and coal preparation, gases and ventilation, and cost accounting.

During the summer about thirty miners and operators took a special intensive course during the strike period.

A building-fund campaign for $2,000,000 is being carried on to develop the college into a State University.

MEN YOU SHOULD KNOW ABOUT

Allen R. Partridge is engaged in private practice at Tepic, Mexico.

R. A. Hall is now superintendent of the Ben Hur property, at Randsburg, Cal.

H. S. Denny has returned to London from Mossamedes, in Portuguese West Africa.

Fred. L. Morris is consulting engineer to the Atlin Silver-Lead Mines Co., in British Columbia.

James M. Little was in New York last week. He expects to return to Arizona within a few weeks.

C. H. Munger and **Philip R. Mather**, of Cleveland, are inspecting the properties of the Pickands, Mather Co. in the Lake Superior district.

Frank Lenoir, mining engineer in the employ of the Alaska Juneau Gold Mining Co., has resigned and will establish himself in Los Angeles.

W. Scott Turner, consulting engineer for the Mining Corporation of Canada, is visiting the Flin Flon copper property, in Northern Manitoba.

R. R. Templeton, petroleum engineer of the U. S. Bureau of Mines, is making a study of oil production practices and pumping equipment in California.

Charles E. Rogers sailed for London last week after a visit of several weeks in this country. He expects to make a business trip to South Africa in the near future.

R. S. Walker, of Cleveland, consulting engineer for the M. A. Hanna Co., has returned East after transacting business matters at the office of the company in Duluth.

B. D. Stewart, territorial inspector of mines, has been advanced by the Director of the U. S. Bureau of Mines to take general charge of the Bureau's activities in Alaska.

Fred Hellman was in Juneau on July 28 on his return from the Keno Hill district, Y. T. Mr. Hellman will make a study of the mining method developed at the Alaska Juneau Gold Mining Co.'s mine.

A. G. Larson, mining engineer of Spokane, returned to his home city the first week in August, after a professional visit to the Daly-Alaska property, on the Alaska side of the Portland Canal district.

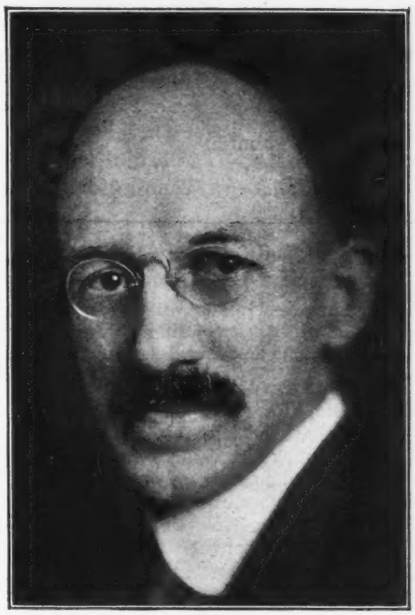
Lewis G. Westgate has arrived in the Pioche district, in Nevada, to begin reconnaissance work for the U. S. Geological Survey. Mr. Westgate will be joined later by **C. H. Dane** and **D. O. Hewett**.

George Clothier, Provincial resident mining engineer of the mining district centering about Prince Rupert, B. C., has been in the Stewart and Anyox districts, in northern British Columbia, recently.

L. R. Clapp will succeed **J. A. Bancroft** as assistant manager of the Granby Consolidated Mining, Smelting & Power Co.

W. H. Hannay, metallurgist for the Trail smelter, is at Thane, Alaska, superintending the shipment to Trail, B. C., of mill machinery purchased by the Consolidated Mining & Smelting Co. from the Alaska Gastineau.

E. A. Holbrook, the assistant director of the U. S. Bureau of Mines, has accepted an appointment as dean of the School of Mines of Pennsylvania State College. The employment of Mr. Holbrook is a part of an effort to build up an outstanding school of mines in the center of Pennsylvania's great coal-mining region.



E. A. Holbrook

Howard Evanson, one of the consulting mining engineers attached to the Pittsburgh staff of the U. S. Bureau of Mines, has been called to Washington to serve as special assistant to Director H. F. Bain during the coal emergency.

Walter J. Eaton, for the past year mine superintendent for the Smuggler Union Mining Co., in Colorado, has resigned and will leave Telluride Sept. 1 to make an extended trip through the Northwest, after which he expects to return to Mexico.

Waldemar Lindgren, professor of economic geology at the Massachusetts Institute of Technology, formerly in charge of the Western division of the Geological Survey, has been making a survey of the geology of the Jerome district, Arizona.

Howard F. Wierum, who has been in charge of operations of American Minerals Production Co., near Valley, Wash., for about five years, is severing his connection with that company, except in an advisory capacity, and announces his intention of entering the plastic magnesite production field.

R. M. Murray, formerly assistant general manager for the Mount Lyell Mining & Railway Co., Tasmania, has been appointed general manager in place of the late Robert Sticht.

Mining and metallurgical engineers visiting New York City recently included **Maurice Cocherell**, of London, England; **Robert S. Lewis**, of Salt Lake City, Utah; **E. C. D'Yarmett**, of Wichita Falls, Tex.; **B. Barnes**, of Bauxite, Ark.; **R. L. Baldwin**, of Milwaukee, Wis.; **J. Nelson Nevins**, of Pasadena, Cal.; **Wm. C. McNutt**, of Elk City, Idaho, and **F. G. Lasier**, of Detroit, Mich.

OBITUARY

Harry Whitney Treat was killed near Chilliwack, B. C., on July 31, in an automobile accident. He was fifty-seven years old, and leaves a wife and two daughters. His home was in Seattle. He was occupied at different times in various mining ventures in the Northwest, including the exploitation of a copper property on Texada Island.

James R. Thompson, prominent mining engineer of the Lake Superior iron ore district, died on Aug. 6 at his home in Ishpeming, Mich., at the age of fifty-seven years. He was one of the outstanding figures in the early development of the iron-ore districts of northern Michigan. After graduating from the University of Wisconsin, Mr. Thompson went directly to the Lake Superior iron-ore district, where he served successively as chief engineer of the Jackson mine, at Negaunee, the Iron Cliffs Co., and the Lake Superior Iron Co. at Ishpeming. From the last post he went to the general managership of the Newport mine for the Schlesinger interests. He is credited with the discovery of the enormous deep-lying ore deposits of the Newport mine, at Ironwood, Mich., which gave that property its place as the largest underground iron-ore mine in the world. He was general manager for the Newport Mining Co. for several years, and became an authority on deep mine hoisting. In 1910 he severed his connection with the Newport mine to become general manager of the American mine at Diorite, Mich., in which property he had an interest. The American mine was abandoned in 1918 by the operators, the M. A. Hanna Co., owing to depletion of the ore reserves, and since that time Mr. Thompson had been developing some valuable green marble deposits of the Upper Peninsula. He was also president of the Lake Superior Loader Co., marketing the Armstrong underground automatic loading machine. Mr. Thompson was a keen geologist, a mechanical and mining engineer of note, and an inventor who had made important contributions to the field of iron-ore development and treatment. He was an indefatigable worker, a wide reader, and a man who evinced a vital interest in humanity.

THE MINING NEWS

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Leading Events

CANANEA CONSOLIDATED resumed the production of copper on Aug. 15 after a prolonged shutdown.

Reports on war mineral claims should not be too detailed and exhaustive, the Secretary of the Interior has ordered. In ascertaining the commercial value of a property a liberal policy must be followed.

Creation of an "oil and minerals administration fund," to provide for the expense of supervising all leases and for storage facilities for the oil or gas produced by them, has been proposed by Secretary Fall.

Producers of non-metallic minerals are urging the necessity of a Government appropriation for research in their field and also that an experiment station of the Bureau of Mines be devoted to such work.

Further adventures of the Queensland Government in conducting some of its mining enterprises are described by our Brisbane correspondent on p. 340.

The end of the coal strike is thought to be in sight, according to the general opinion in official circles in Washington.

Cananea Consolidated Resumes Production of Copper

Force Employed in Recent Months to Be Gradually Increased—No Shortage of Labor

The Cananea Consolidated Copper Co., Cananea, Son., resumed production Aug. 15, operating two blast furnaces and one reverberatory. A force of 1,500 has been employed for months past and is being increased to 3,500, mainly Mexican, though most of the foremen are American. According to General Manager Evans, there is no shortage of labor.

Much work has been done on the reduction units with the purpose to secure lower production costs. The concentrator has been remodeled, with a much simpler flowsheet, though not with increased capacity; a screen plant has been installed, with a fine-ore bedding system, thus throwing more ore to the reverberatories; new boilers have been added to the reverberatory system, with expectation that better use will be made of the excess heat, and material improvements have been made around the power house. All employees will be required to stand physical examination. Physically disqualified persons will not be hired.

Smelter Smoke Hearings Ended at Rossland, B. C.

The last hearing in the smelter smoke arbitration case against the Consolidated Mining & Smelting Co., involving claims for damages by ranchers along the Columbia River near Trail, B. C., was held at Rossland, B. C., early in August. The arbitrator, Judge Forin, is now considering the evidence, which is voluminous, and it is expected that a decision will be handed down during the fall.

British Columbia to Support Steel Company

Will Guarantee Bonds Up to $4,000,000 —Favors Much Smaller Pig-Iron Plant Than That Proposed

Representatives of the Coast Range Steel, Ltd., have submitted proposals to the British Columbia government having in view the establishment of an iron and steel industry. They say that they have the assurance of the Trade Facilities Committee of the British government of support to the extent of $4,000,000, or one-third of the estimated cost. They assert also that the Dominion Government has promised backing not to exceed the same figure. These agreements were conditional upon the Province guaranteeing interest and principal upon bonds up to another $4,000,000. Thus the project is expected to represent an outlay of $12,000,000.

Under the circumstances the British Columbia Government undertook to support the Coast Range Steel, Ltd. Those interested in the company were told that the Government would be prepared at the next session of the Legislature to submit legislation, making the iron orebodies of the Province available for use either on a percentage, tonnage or royalty basis; that the present legislation providing for a bounty on pig iron produced in British Columbia would be repealed; that the Government would promote legislation authorizing a guarantee of the company's bonds to the extent of one-third of the amount required to establish an iron smelting plant; and that this guarantee would be conditioned upon the Dominion Government and the Imperial Trade Facilities Committee guaranteeing the other two-thirds of the capital required; upon a thorough investigation being undertaken covering raw material, plans, specifications, locations, contracts, conduct, management and financing of the company and probabilities of success satisfactory to the Government; upon the Government of the Province having security for its guarantee ranking equal with the security of the Dominion Government and the Facilities Committee; and further it being understood that if the operation of the blast furnace to be established is fully satisfactory the guarantees will be extended to include a steel producing plant and also rolling mills.

It is noted that this is not a full endorsement of the Coast Range Steel proposals. The latter contemplate a plant with a daily capacity of 1,000 tons of pig iron together with auxiliary plant for the production of steel rods, tin plate, and similar products. The Government felt that this, perhaps, was providing too large an installation for a beginning, and therefore has gone on record as favoring a plant capable of a daily production of 400 tons of pig iron, the auxiliary plant needed for the production of steel rods and steel in other forms to be left for consideration, pending the successful start of a blast furnace industry.

Another Dredge to Be Sent to Malay Peninsula

The all-steel dredge at Carrville, Trinity County, Cal., belonging to the Pacific Gold Dredging Co., is to be dismantled and shipped to the Malay Peninsula, where it will be set to work dredging for tin instead of for gold, according to an announcement made recently in Carrville at a meeting of the dredge masters of California. The dredge was built in 1916 at a cost of over $500,000. The cost of hauling the material and equipment from Redding to Carrville was over $60,000.

News from Washington

By PAUL WOOTON
Special Correspondent

Urges Fund to Help Administer Mineral Leasing Act

Secretary Fall Would Also Have Bureau of Mines Supervise All Permits and Leases

To facilitate the administration of the Mineral Leasing Act, the Secretary of the Interior proposes the creation of an "oil and minerals administration fund" and the concentration in the Bureau of Mines of all supervision over permits and leases, including Indian lease acts; the collection of royalties and the construction of necessary storage tanks when petroleum can not be disposed of economically. Without allowance for storage, the aggregate of appropriations necessary for all the work of administering the Leasing Act is $590,000. In setting forth the need for this change, Secretary Fall says:

"Specific appropriations for these purposes carried in the last Interior Department appropriation bill aggregate $299,745, in addition to which $75,000 was transferred from the naval fund. Additional estimates are being made because of the necessity for supervision of the Red River, Oklahoma, district, special work in Alaska and two new fields on the public domain, particularly the one at Sunburst-Kevin, Montana.

"We have been compelled to transfer men from the Cat Creek, Mont., district to this new field in which wells drilled eight miles apart, and producing from 50 to 200 bbl. each, indicate extensive oil production in the very near future. We do not have sufficient men to handle this work at the present time and we are constantly sending experienced men backward and forward from one district to another. It is particularly necessary, when a new district is opened, to have expert and experienced men on the ground.

"The total additional appropriations needed, including the amount necessary for the supervision of Indian lands, will aggregate $215,255, estimates for which now are being submitted.

"If we could today erect one storage tank of 80,000 bbl. capacity in the Cat Creek field, Mont., we could supply therefrom several small refining plants and not be compelled to make time contracts with one company, at their own prices, for the disposition of our oil as it comes from the wells. This policy of immediate disposition in such cases only inures to the benefit of some present existing monopoly.

"Congress, when enacting the general Leasing Act of February 25, 1920, as well as the acts providing for the leasing of minerals upon Indian lands, made no appropriation for the expense of administration and supervision over such leases and the products thereof, or for the providing of storage facilities for oil or gas produced from such leases. To prevent waste, damage to wells, to insure the payment of royalties due, and to secure the greatest possible conservation and production of the various minerals, particularly oil and gas, close and expert supervision is absolutely essential.

"This fact was recognized by the Interior Department, and, through the Bureau of Mines and other bureaus, arrangements were made at the outset to exercise as much supervision as existing facilities would permit. The matter was taken up with Congress and appropriations have been made from time to time for the payment of the expense of administration and supervision over leases and permits granted under the General Leasing Act.

"Experience has demonstrated that a still closer supervision will result in both financial and other benefits to the Government and other beneficiaries of the law. The same applies with equal force to leases of minerals upon Indian lands.

"Lessees are generally willing, in accordance with commercial custom, to hold the oil or gas produced for not exceeding thirty days, but at the end of that time the Government is forced to make provision for the disposition thereof, regardless of market or other conditions.

"If the Secretary were given funds and authority, large additional returns from the oil and gas produced could be had by providing a limited amount of storage where the oil and gas could be held for better prices or better market conditions.

"The production of oils and the consequent royalties being and to be derived by the Government, directly under the terms of the Lease Act, and indirectly through the administration of the Indian Lease Act, is growing so in quantity and value that we have just been compelled to submit additional estimates for the administration of this branch of the Government business.

"The action I have indicated is necessary, not only as a conservation measure but because it will be profitable to the Government. Under this arrangement, the fund thus created will be sufficient for all needs, both those which heretofore have been appropriated for directly and those for which additional appropriations now are being asked."

Tracing Platinum Thefts

Responsibility for recent thefts of platinum from the laboratories of the Bureau of Standards is thought to have been fixed by the arrest of a negro janitor. Most of the stolen platinum was recovered from a Washington jeweler, to whom the janitor is said by the police to have sold the metal in the very small amounts which he is said to have taken from time to time.

Bounty on Potash Defeated

The proposal of the Senate Finance Committee to substitute a bounty for the protective duties previously prescribed for potash was rejected by the Senate on Aug. 8 by a vote of 30 to 32. The vote was taken in committee of the whole. An opportunity will be afforded to bring the matter up again when the bill is considered in the Senate proper, but it is thought that the chance is slight of saving potash from the free list.

End of Coal Strike Thought to Be in Sight

Washington Considers Result a Draw —Fundamental Ills of Industry Remain Unchanged

Events at Cleveland have progressed to the point where they foreshadow the beginning of the end, observers in Washington believe. The agreement promises to bear enough semblance to a national arrangement to save Mr. Lewis' face. It is regarded here, however, as evident that Mr. Lewis has lost his fight for a national agreement. It is regarded as a farce to follow out the old plan of two operators and two miners from each state when the two votes from Ohio represent practically all of the tonnage covered by the agreement likely to be made.

Federal officials are inclined to regard the result as something of a draw. The strength of the union has been clearly demonstrated. The mine workers have successfully resisted a reduction in their pay. The check-off will continue and working conditions remain unchanged. The operators at least have broken up the central competitive field. The prospects are that the union will lose the weakly organized districts. No one of the fundamental ills of the coal industry has been remedied. Every issue involved in this strike must be fought out again. A truce now appears to be a certainty, but it is a make-shift one.

Minute Examination of Claims for Relief Unnecessary

Secretary Fall Issues Instructions Regarding Handling of War Mineral Cases—Desires Liberal Policy to Be Pursued

Positive instructions have been issued by the Secretary of the Interior against the making of too detailed and exhaustive engineering reports in War Minerals Relief claims.

The function of the engineers attached to the staff of the War Minerals Relief commissioner, he says, is simply to ascertain facts and to submit reports and recommendations. They are not to decide cases, he says. That function is to be left for the commissioner and the Secretary of the Interior. In regard to ascertaining commercial value, Secretary Fall has let it be understood that he desires that a liberal policy be pursued. He expresses the opinion that if developments on adjoining properties, or if surface and geological indications constitute showing of sufficient promise to warrant a prudent miner to believe that he could develop a mine of commercial importance, and when he actually performed work and extracted ores of a commercial value, his claim should be considered even though subsequent developments made it impossible to rate the property as a commercial mine.

A case used to illustrate the point made in the foregoing is that of the Sulphur Gulch Manganese mines. This claim was denied on the ground that the mine produced less than 50 tons of ore. With the extraction of that amount of ore, barren rock was exposed on the sides and the bottom of the excavation pit. While a final opinion has not been rendered in that case, First Assistant Secretary Finney expresses the opinion that the claim should be considered, since the property was adjacent to a proven mine. The property had promising outcroppings and the claimants secured the opinion of mining engineers that a mine probably would be developed.

Secretary Fall is of the opinion that it is not necessary for more than one engineer of the commissioner's staff to visit any one mine and he doubts the advisability of sending an engineer to examine the property when the claim is for less than $1,000 and where it is possible to obtain the facts otherwise. He suggests that it may be possible in many instances to secure proof by correspondence with local engineers, thereby avoiding the expense and delay of field examinations. Mr. Fall stated positively that he does not believe it is necessary to make such minute examinations of claims as was the practice under the former commission.

Bureau Station for Research in Non-Metallic Field Wanted

Producers Urge Need for Appropriation for Next Fiscal Year

Producers of non-metallic minerals are taking time by the forelock so that no plea of lack of information can be made by the appropriations committees of the Senate and of the House of Representatives if they fail to recognize those industries in the appropriations to be made for the fiscal year beginning July 1, 1924. Not only do these producers believe that the Federal Government should appropriate for a service which would allow the Bureau of Mines to be a clearing house for statistical and other information necessary to the intelligent conduct of their businesses, but they think they should have one of the experiment stations.

Seven of the ten mining experiment stations authorized by Congress are in operation. One of the remaining stations should be devoted to a study of the non-metallic minerals, it is contended. The plea for Federal recognition is based primarily on the importance of the industry. The annual value of its products exceeds $500,000,000. Emphasis, however, is being placed also on the fact that this production is the aggregate of a vast number of small and independent enterprises.

Government's Silver Purchases

Purchases of silver by the Bureau of the Mint during the week ended Aug. 12 totaled 1,251,000 fine ounces. This brings the total purchases under the Pittman Act to 123,497,506 fine ounces.

News by Mining Districts

London Letter

Robinson Deep "A" Shares Advance to High Mark Without Apparent Reason

BY W. A. DOMAN

London, Aug. 4—For some quite inadequate reason interest has switched on to the "A" shares of the Robinson Deep, Ltd., and they have jumped up from about 5s. to 21s. 3d. There are 500,000 of these shares, of the nominal value of 1s. each, the remainder of the share capital of £806,807 being in "B" shares of £1 each. An attempt has been made to explain the rise by saying that developments in certain parts of the property are exceptionally favorable. This may be so; yet it does not seem to justify the advance. True, the "A" capital is small, and very little is required to pay a dividend. It seems to be forgotten, however, that the financial condition of the company is far from strong. Looking at the position of the undertaking as disclosed in the directors' last report, there is no possibility of any distribution for some time to come. The company already has a loan of £300,000 in equal shares from the Consolidated Goldfields of South Africa and the Central Mining & Investment Corporation, which is due to be repaid at the end of this year; it cannot meet the liability, while, in addition, further capital expenditure, said to be £395,000, has to be provided for. For this year £115,000 has been authorized, and at March 31 there was only £50,000 in hand. The company has no capital funds, and unless the working profit is sufficiently big to provide for the large sums which will be necessary for shaft sinking and for the development of the lower levels, as well as to meet loan commitments, there is no real profit. The only way out of the difficulty is to reduce the costs, and much is being done in this direction. Last year's figure was 26s. 6d. per ton, against 29s. 3d. per ton in the previous year, though the grade of ore dropped from 35s. 3d. to 31s. 8d. per ton. The gold "premium" was equal to 6s. 3d. per ton, so that, without it, working would have been carried on at a loss. The average price of gold realized last year was approximately 105s. per oz., as compared with 112s. the previous year. The cost averaged £4.93 per oz. The value of the shares naturally depends in the main upon earning capacity, so that a price of 20s. for a 1s. share in the present stage of affairs is rather high. The "A" shares had the right to have distributed among them a sum at the rate of £200,000 per annum, or 8s. per share, from 1915 to the end of 1919; 3s. per share from Jan. 1, 1920, to the end of 1936; 2s. 6d. per share for 1937; 1s. 6d. per share for 1938 and 1939, and 6d. per share for 1940, and thereafter, until the capital on the "A" shares has been paid off, interest at the rate of 5 per cent.

AUSTRALIA

Costs at Mount Lyell Criticised—Vicissitudes of State Mining Enterprises in Queensland

Special Correspondence.

Melbourne—An independent investigator has published a report under the title "Economics at Lyell," in the course of which he states:

"The directors [of Mount Lyell Mining & Railway Co.] do not publish the value of the Lyell product separately from the product of their other enterprises. The result is that, while they complain concerning wages that they are conducting their Lyell operations at a loss, their employees are not impressed when they know that the published balance sheet shows a profit of £51,000 for the worst year. If those sworn statements are examined, however, it does not require any further and secret investigation to show that a serious loss on Lyell itself is being incurred. On the operating expenses here alone at least £100,000 must have been lost last year. This is more than made up from the large profits from the mainland enterprises."

He estimates the cost of producing and marketing a ton of copper, inclusive of fraight and all other charges, as follows:

	1916	Average 1916-1921	1921
All costs	£79½	£94	£101
Price of standard copper, London	116	102	69

A glance at these figures shows how the costs have increased while the prices of copper have decreased.

The Mount Lyell company, however, has been able to meet the situation by reducing the tonnage of ore required to produce one ton of copper so that the increase in the operating costs has not been in the same proportion to the output. It is this fact which has enabled the company to continue operating while so many other mines have been compelled to close down.

Queensland

Brisbane, June 17—Another of the Government concerns, the Einasleigh state copper mine, has, like the Irvinebank tin treatment works, been shut down, and, as the rails leading to the mine and the machinery are being removed to another state mine, the fate of the Einasleigh may be taken as finally sealed. The reason given officially is that the grade of the ore, which has been the mainstay of the Chillagoe state smelters until lately, has become too low to be profitable. This copper mine, a large low-grade property, was acquired in 1911 by the Chillagoe company, and in 1919 was purchased by the government with the Chillagoe and Etheridge railways and the Chillagoe smelters. The width of the lode is 25 ft., but the depth reached in the workings is only between 600 and 700 ft. Following a satisfactory

record for last year, the closing of the mine has come as a surprise.

In 1921, from the lowest to the highest level much development work was done, improvements were made to the surface equipment, and a new and massive lens of ore was struck and opened up for 40 ft. in length, giving an average of 10 per cent. Additional work was then expected to further augment the resources of the mine, but the ore must have become much leaner since —coming down, it is said, to an average of 2½ per cent; hence the abandonment of the property.

The equipment of the Einasleigh mine is being taken to the Lady Jane, one of the Mungana mines, nearer Chillagoe, lately bought by the government to assist in supplying the state smelters, and the 350 men who were employed in the former are migrating in the same direction. Another of the Mungana mines purchased by the state is the Girofla, where on three levels at depths of from 100 to 300 ft. important orebodies have recently been uncovered.

A new state battery has just been opened at Kidson, the chief center of the Oaks, a low-grade gold field inland from Cairns. On this field there were undoubtedly not crushing facilities either sufficient or efficient enough to treat the ore of the smaller mines, but the one or two larger companies operating there could meet their own requirements. The Oaks ore, which is excavated from open cuts and smaller pits, last year averaged 3 dwt., giving a value of 10s. 1d. per ton. The bulk of the material was mined by one company and the owners of two other holdings, the remaining smaller mines contributing only 2 per cent. It is for these smaller mines that the state battery has been built. This mill will give a more complete direct extraction than was before available. These mines have accumulated a good supply of ore for the battery to start upon, but when this has been worked off it is doubtful whether there will be sufficient to keep the government plant going, and it is very probable that this will before long rank as another state enterprise that is unprofitable.

Another difficulty seems to have confronted the government in its attempts to help the sapphire miners of the Anakie gem field. After the agreement with Messrs. Rubin Bros., of Paris, for the marketing of the gems broke down, it was arranged, in order to relieve the depression that existed, and still exists, on the field because of the difficulty of disposing of the gems, that the government should make advances to the miners on the basis of 75 per cent of the current market value of the stone, the gems to be held by the government as security, the maximum weekly allowance to be fixed at £2 for a married and £1 for a single man. It is now stated that a hitch has occurred in this arrangement, and an officer of the Mines department has been dispatched to the field.

CANADA

British Columbia

Hedley Gold Mining Co. Resumes Milling

Hedley—The Hedley Gold Mining Co., owners of the Nickel Plate mine, have resumed milling operations and are employing 150 men in mine and mill. This mine is one of the best gold producers in British Columbia and the only producer of arsenic, which is a byproduct. In addition to the regular mining operations an extensive program of diamond drilling has also been outlined for the season.

Silverton—The Standard Silver Lead Mining Co., which has exhausted the ores in the Standard Silver-Lead mine, is utilizing the $400,000 left in the treasury after distributing dividends of $2,700,000 in operations of former years, in acquiring options on other British Columbia properties. The company recently closed an option on the Ivy Fern group, on Cultus Creek, at the lower end of Kootenay Lake, and is driving a 250-ft. crosscut to develop a strong silver-copper vein exposed on the surface.

The company has also acquired interest in the McAllister mine, on the north fork of Carpenter Creek, in the Slocan district. The vein here has been developed by means of crosscut and drifts to the 300 ft. level, disclosing an extensive body of ore reported as averaging 25 oz. silver per ton. A 1,200-ft. crosscut is being driven to develop the vein on the 700 level.

Ainsworth—The Lakeshore Mining Co., financed by Eastern capital, is developing the property by driving a 750-ft. crosscut to tap the vein, which has been explored to the 200 level by means of a shaft from the surface. Shipping ore 2 ft. wide is reported at the bottom of the shaft. The crosscut will gain additional depth of 175 ft. on the vein.

Ontario

Hollinger to Increase Dividend—International Nickel Ships Matte

Porcupine—L. H. Timmins, director of the Hollinger Consolidated, stated at Montreal that dividends would soon be increased. He said that negotiations with the government respecting hydroelectric power have reached a stage where it may be said that the company will proceed immediately with the development of power sufficient to its needs. This work is expected to be completed within a year and will enable the company to double its output. In regard to the newly acquired Schumacher property Mr. Timmins stated that it might be two or three years before any of the ore of that mine is touched.

Sudbury — The International Nickel Co. has shipped ten carloads of nickel matte from its smelter at Copper Cliff to the Port Colborne refinery. This is the first shipment to be made since the plant was closed down about a year ago, the matte being in stock at the time. It is expected that the demands of the refinery will require the blowing in of two furnaces at Copper Cliff within a month.

The Mond Nickel Co. is also showing increased activity. Two thousand tons of matte has been shipped from Coniston to the company's refinery at Swansea, Wales, and the shipment of several thousand tons more is planned for the fall months.

Porcupine — The directors of the Vipond Consolidated Mining Co. have accepted the offer of A. E. Moysey of 40c. per share for 333,333 shares with a year's option on the balance of treasury stocks, being 666,667 shares, at the same price. The deal will ensure sufficient funds to carry out an expensive plan of development.

Porcupine—Shareholders of Porcupine Crown have ratified two bylaws providing for the taking over of the property of the North Crown Porcupine Mines, in which the Porcupine Crown is interested, and an increase in the capital stock to $4,000,000. The obligations of the North Crown to the Porcupine Crown are to be cancelled, and of the 1,000,000 new shares 400,000 will remain in the treasury to provide working capital and 600,000 to go to the North Crown as the balance of the purchase price.

Dryden—The Contact Bay Mines has taken up its option on the Redeemer gold mine south of Dryden, after spending $30,000 on development work, the purchase price being $100,000, including this expenditure. The shaft is down 225 ft., and a large amount of ore has been taken out. There is a ten-stamp mill on the property, which will be trebled in capacity.

OREGON

Bay Horse and Iron Dyke Mines Shipping Steadily

Huntington—The Bay Horse mine is shipping 50-oz. silver ore at the rate of three to four cars weekly to the Bunker Hill smelter at Bradley, Idaho.

Baker—The Baisley-Elkhorn mine in the Cornucopia district is projecting a crosscut tunnel about a mile long to gain several hundred feet additional depth below the upper workings.

Homestead—The Iron Dyke copper mine is shipping about ten cars weekly. The shipments consist of six to seven cars of crude ore and three to four cars of concentrates. Fifty men are on the payroll. Most of the crude ore is coming from the 800 level.

WASHINGTON

Chewelah—The shaft of the Silver Summit mine has been cleaned out, preliminary to resuming development of the property. It is believed that the mine can be put in shape to enter the producing ranks at an early date.

Leadpoint—The small force employed at the Gladstone Mountain mine is to be increased at an early date. Output to date since the property resumed operations in the spring is seven cars.

IDAHO

Ponderay Company's Property Sold Under Foreclosure—Yakt Company Organized

Bonners Ferry—The Cyanide Gold Mining Co., operating the old Buckhorn mine twenty-five miles northeast of Bonners Ferry, is erecting a 100-ton cyanide mill.

Sandpoint—The property of the Ponderay Mining & Smelting Co., consisting of a smelter at Kootenay, Idaho, mining claims on Pend d'Oreille Lake and a steamer, has been sold under foreclosure proceedings on behalf of Union Trust Co., of Spokane, to recover the sum of $59,938 principal and $23,905 interest. The sale was set for Aug. 10, at Bonner County courthouse, at Sandpoint.

Leonia—The Yakt Mining & Power Co., capitalized at $10,000,000, has been incorporated under the laws of Washington to work extensive gravel banks on the Yakt River on the Idaho-Montana boundary a few miles north of Leonia, Idaho. The company has located 4,000 acres of gravel said to carry gold and platinum in the black sands. The company also has water rights to the full flow of the Yakt River. Dr. John E. Bucher, formerly professor of chemistry at Brown University, is president and T. J. Hollinger, of Bonners Ferry, vice-president. J. M. Schnatterly, of the Idaho Gold & Ruby Mining Co., is consulting engineer.

The Idaho Gold and Ruby Mining Co. started hydraulic mining Aug. 1. This company has been several years developing a water supply to mine immense gravel banks on Boulder Creek six miles south of here. A large concentrator has just been completed to recover the black sands after the free gold has been recovered by amalgamation. Sixty men are now on the payroll and twenty more will be added at once to hasten the work.

Wallace—The threatened litigation between factions of the Tarbox Mining Co. has been settled amicably out of court. The case has been dismissed upon request of the attorney for the plaintiffs.

Beer, Sondheimer Appeal Adverse Decision in Ore-Stowage Suit

An appeal has been taken to the Supreme Court by the Beer, Sondheimer & Co., from the Circuit Court of Appeals, Second circuit, from a recent decision which held it responsible to the Cuban Steamship Line for improper stowage of a cargo of high-grade copper ore from Cuba to the United States. The cargo consisted of 3,500 tons of copper ore and the vessel had to return from Guantanamo Bay to Santiago to restow the cargo. The steamship line won its suit in the lower court to recover from Beer, Sondheimer & Co. the expense in connection with the return of the vessel to Santiago and the restowage of the cargo which it claimed had first been improperly stowed.

ARIZONA

United Verde's Cottrell Precipitation Plant Reported Working Efficiently—C. & A. Restores Bonus System

Clarkdale—The Cottrell smoke treatment plant has been in operation at the United Verde smelter for several weeks, effectually changing the great clouds of black smelter smoke to wisps of fleecy vapors that seem to have neither substance nor odor, escaping from the new high stack. It is expected to precipitate at least 95 per cent of the solids in the smoke from the blast furnaces, the converters and roaster. Smoke from the reverberatories has little in it of an offensive nature. The new plant cost $750,000, but is expected to work great economies, as well as remove a fruitful source of litigation in the vicinity. It was erected by the Western Precipitation Co. of Los Angeles. While with many improvements, especially in the way of added protection for employees, it is, in general, similar to about 100 plants heretofore erected by the corporation. The operating superintendent is F. J. Mooney, who has been in charge of the United Verde crushing operations.

Electricity for operation is secured from the hydro-electric system of the Arizona Power Co., delivered in a 2,300-v., 3 phase, 60-cycle alternating current. This, in the separate power house provided, is changed into an unidirectional pulsating current that may be stepped from 50,000 volts to even 100,000. Within the precipitation building are three systems for ridding the smoke of its solid constituents, these including screens, wires, plates and pipes, between the positive and negative poles of the artificial lightning discharge. Separate sections of the treatment plant are disconnected for collection of the dust, which is removed by automatic tapping devices, falling to conveyors for carriage to the reverberatories for final extraction of its remaining metallic contents. A view of the plant is shown on the opposite page.

Bisbee—No increase of production from the Copper Queen is contemplated in the near future. The ore reserves in the limestone mines are about the same as last year, 2,000,000 tons, while in Sacramento Hill are 20,000,000 tons of milling or smelting ore and 8,000,000 tons of low-grade leaching ore.

Restoration of the employees' bonus system is announced by the Calumet & Arizona, effective at once for those whose employment was suspended by last year's shutdown.

Florence—E. Payne Palmer, a Phoenix physician, at a sheriff's sale in Florence, has bid in the property of the Pinal Development Co., including thirty-two mining claims in Riverside district, Pinal County, in the Troy section. He had judgment for $10,620 and costs. The mine is a copper-gold property. Palmer is understood to have been the largest individual stockholder in the company.

CALIFORNIA

Salmon River District Active—Keswick Almost Abandoned by Mountain Copper

San Francisco—Activity in mining is in evidence for a distance of about fifteen miles along the Salmon River, from Sawyer's Bar to the Forks of Salmon, Siskiyou County. The Ball Quartz mine has been bonded by Fred Gowing, of Berkeley. He is operating a five-stamp mill. A. Jacquemart, of San Francisco, has purchased the Paddy Cronin placer group, and is making preparations to work the property. The Homestake Quartz mine, owned by R. S. Taylor, of Yreka, is in operation. The Siskiyou Syndicate, of which Irving Luce is president, has a crew of men developing the Cub Bear mine and other claims. Fred Myers has leased the old Hicky Homestead hydraulic mine. Miles Neilon and W. Putnam are developing the property which they located about eighteen months ago in Counts Gulch. J. A. Woodfill and Cleve Barry, of Sawyer's Bar, have a lease on a placer claim in Eddy's Gulch.

The Mountain Copper Co. has all but abandoned Keswick. Only four men are still on the company's payroll, and they will be discharged soon or else transferred to Mathewson, the terminal of the rope tramway running from the Hornet mine to the Southern Pacific railroad.

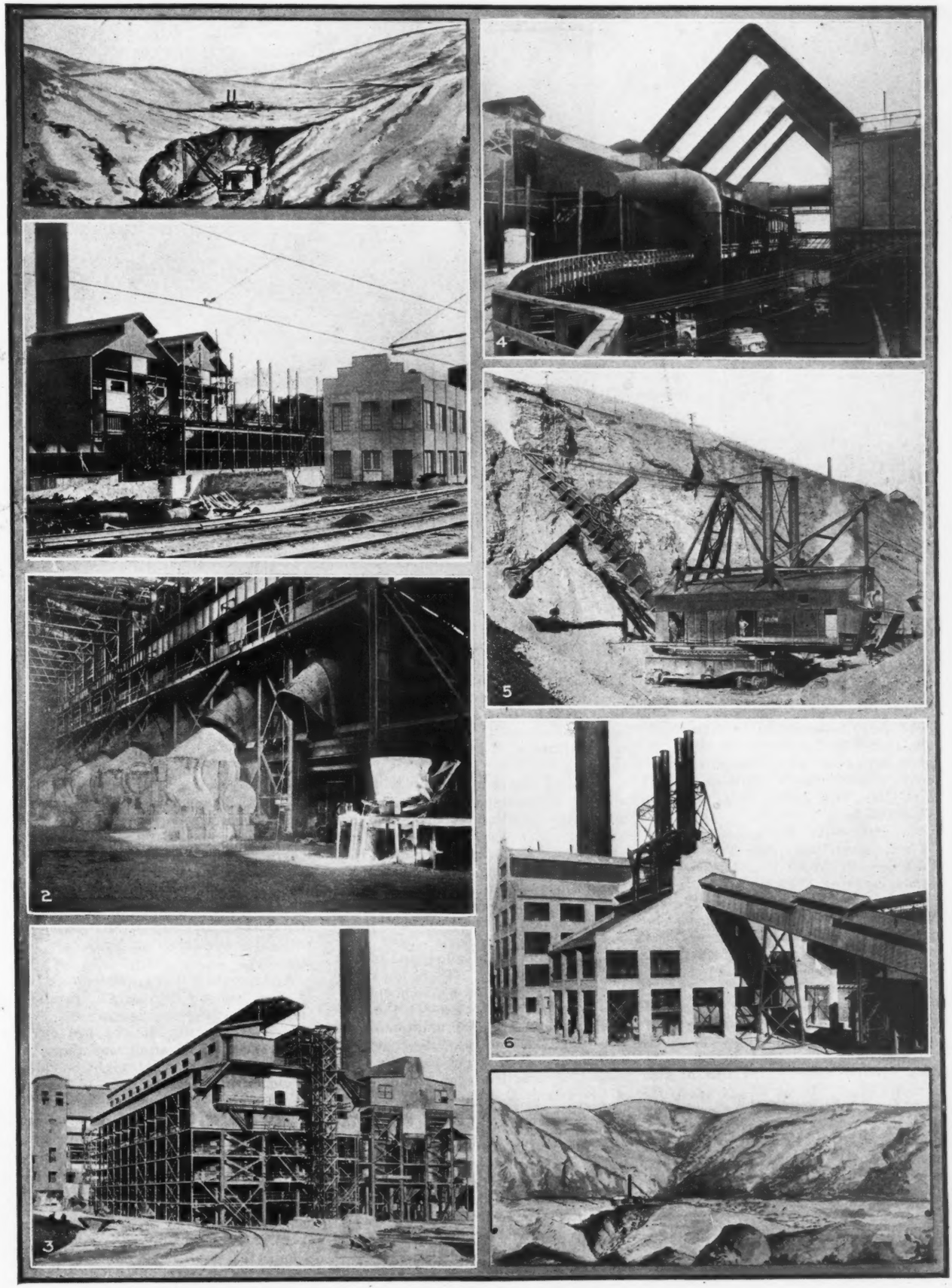
Operation of the old Surprise Placer mine at Berry Creek, in Butte County, was resumed recently. The owner, J. N. Kennedy, has given a two-year optional lease on the property to a San Francisco group of capitalists.

The Pittsburg & Mount Shasta Gold Mining & Milling Co. of Randsburg, has started a new shaft recently within 100 ft. of the north end line of its property, where it adjoins that of the Rand Silver King, Inc.

The old Baltic property, with adjacent territory amounting in all to 200 acres, was recently taken over by the Rand Mining & Milling Co., which has equipped it with necessary electrical machinery. The shaft is now down to a depth of 265 ft., and a station has been cut on the 200 level. The Baltic was formerly a free-milling gold property, most of the ore from which was mined close to the surface.

Miners' Wages Cut in West Australian Districts

The Western Australian Arbitration Court has reduced the basic rate of 16s. per shift to 15s., but mine owners state that this reduction will not enable them to meet the expenses of mining and development work except by leaving unmined much of the ore which in prewar days was classed as payable reserves. The Lake View & Star, one of the large mines on the Kalgoorlie field, has closed down, and unless relief comes quickly in the form of a reduction in the cost of supplies, the decline in the gold output seems to be a foregone conclusion.



Views of United Verde Copper Co.'s plant, Clarkdale, Ariz.

1. Cottrell smoke treatment plant. 2. Converter aisle at smelter. 3. Roaster building. 4. General view of blast furnace department. 5. Steam shovel at work on old slag dump at Jerome. 6. Coal pulverizing plant.

Smelter of American Smelting & Refining Co. at Garfield, Utah

UTAH

Park City Mining & Smelting Co. Acquires New Property

Park City—Shipments for the week ended Aug. 5 amounted to 4,112 tons, compared with 3,902 tons the week before. Shippers were: Ontario, 1,293 tons; Silver King Coalition, 1,177; Park-Utah, 962; Judge, Daly, and Daly West, 680 tons.

The Park City Mining & Smelting Co. announces that it has acquired the West Ontario property of 135 patented claims, covering ground surrounded by productive territory in the Daly, Daly West, Judge, and Silver King Coalition. The West Ontario has been little known, as it was held inactive by a close corporation of Eastern men. These are understood not to have withdrawn, but to have become interested in the Park City Mining & Smelting Co. Recently the latter company has made an important find in its Daly West ground close to the line of the former Judge. A bed of ore seven ft. thick has been opened for a width of 15 ft. and a length of 50 ft., with ore showing in all the faces. Ore has been opened in the Daly West at another point 200 ft. distant from the first-mentioned find, and ore is believed to continue between the two points. Over 600 tons of ore has been shipped from the development headings in these two places. This assays about 100 oz. silver; 15 per cent lead, and 5 per cent copper.

Eureka—Ore shipments from the Tintic district for the week ended Aug. 5 amount to 147 cars as compared with 139 cars the week preceding. Shippers were: Chief Consolidated, 44 cars; Tintic Standard, 35; Iron Blossom, 13; Colorado, 12; Victoria, 10; Eagle & Blue Bell, 9; Grand Central, 7; Swansea, 3; Mammoth, 2; Alaska, 2; Centennial-Eureka, 2; Bullion Beck, 1; Sunbeam, 1.

Work on company account will probably be started soon at the May Day and Uncle Sam mines. These properties are under lease to a leasing company, but with the reservation that company work can also be done. The motor for the Grand Central hoist has arrived, and the change from steam to electric power will be made as soon as possible. Improvements have been made throughout the mine, and modern equipment installed. The company is driving five drifts for development purposes under contract: one on the 1,100 level; two on the 1,300, and one on the 1,600 and one on the 2,300; and development work is being done by lessees on practically all of the levels of the mine. A great deal of ore has been opened and fifty-three lessees are working on ore.

Shipments at the rate of 200 tons daily from the limestone quarry of the Chief Consolidated at Homansville are to begin soon to fill a contract with the Utah-Idaho sugar company. Twice this tonnage can be handled, and as the rock is of excellent quality for sugar refining, a good market is expected by the company.

Moab—Work on the carnotite claims of the Uranium company in San Juan County, Utah, has been suspended, pending better market conditions.

NEVADA

Old Stope of Tonopah Mining Co. Caves to Surface—Conditions Quiet at Divide

Rochester—Bullion production of the Rochester Silver Corporation in July was $40,500, with net earnings approximately $9,000, which is about normal. No particular change in underground conditions is reported, with satisfactory developments on the 500 level, where two drifts are being driven on branches of the Windlass vein.

Tonopah—Conditions in the Tonopah district are good. So far, no effect of the coal or railroad strikes has been noticeable and labor conditions are satisfactory.

A large stope in the Mizpah ground of the Tonopah Mining Co. caved to surface on July 30, leaving an open hole approximately 150 by 200 ft. by 100 ft. deep. This stope was above the 300 level and was what might be called an underground glory hole, in that no actual mining had been done in it for several years, the caved material being drawn out as needed. The assay office and storehouse were drawn into the hole, with losses estimated at $12,000. The cave was not unexpected, although its extent was a surprise, and has not interfered with underground operations appreciably.

Reported bullion shipments, representing the clean-up of operations during the last fifteen days of July, are as follows: West End $108,000, Tonopah Extension $75,000, Tonopah Mining $60,000. No returns have as yet been received from the Tonopah Belmont,

the largest shipper, but estimates place the value of its bullion about as usual.

The Victor shaft of the Tonopah Extension has reached a depth of 2,000 ft. As soon as the station is completed, crosscutting on the 2,000 level will be started and shaft sinking resumed.

Klondyke—It is reported that the orebody has again been recovered on the 130 level in the Golden State mine, now owned by the Knox Divide Mining Co. The ore is said to average about $25 per ton and shipments will be resumed to the Tonopah mills. Active work is being done in several lease blocks of the district.

Divide—On the whole, conditions are rather quiet in the Divide district. Many small properties are doing a limited amount of development work, with no discoveries of importance reported. The Tonopah Divide mine continues its regular production of 50 tons daily, and is doing development work on the second, third, fifth, eighth, thirteenth and fourteenth levels.

Las Vegas—The first carload of refined borax from the big mine and mill of the West End Chemical Co. (Borax Smith's), thirty miles east of Las Vegas, has been shipped from Las Vegas to San Francisco. The aërial tramway is in operation at the mine, carrying ore from the mine to the mill.

The company is operating several wagon trains daily between the mill and the railroad. These trains, consisting usually of three big trailers, are propelled by caterpillar tractors.

Pioche—The Bristol Silver Mines Co. has started to hoist ore from the big shrinkage stopes adjacent to and above the 9th level mine. It is planned to handle 100 tons a day as at least a year's supply is broken in the stopes. Part of this will be shipped to the United States Smelting Co. on contract and the rest to the International Smelting Co. at Toole.

A large tonnage is now being shipped by the Prince Consolidated from its tailing piles at Bullionville and Dry Valley, these shipments making up the greater part of the tonnage shipped from the Pioche district for the week ended Aug. 9, as follows: Prince Consolidated, 940 tons; Bristol Silver, 260, and Black Metals Lease, 45. Total, 1,245 tons.

Ely—It is planned to have the first unit of the Nevada Consolidated mill, when re-built, in operation early in 1923. At present work is still confined to cleaning up the tangled wreckage. The smelter is running on the richer grades of ore from the Ruth mine. A large number of men are working in the district.

The Ely-Calumet Leasing Syndicate, which has been operating the Ely-Calumet mine for two years, is now erecting a 75-ton ore bin at the mine and a 150-ton ore bin adjacent to the Nevada Northern Railroad. Zinc ore will be shipped to the Utah Zinc Co. at Murray.

COLORADO

A. S. & R. Announces New Schedule for Aspen District—Canterbury Tunnel Cuts Roseville Shaft Workings

Special Correspondence.

Aspen—Effective as from Aug. 1, the American Smelting & Refining Co. has announced a new open ore schedule for the Aspen district. The schedule is designed to encourage operations in the district and is of distinct advantage to producers of low-grade lime ores. It is believed that the new schedule will result in an increase in operations of leasers on the Smuggler and Brown properties.

Leadville—After a period of inactivity for several years, operations have been renewed in Iowa Gulch. The Big Chicago mining company, backed by Denver capital, will extend the Big Chicago tunnel through the Western fault in an attempt to reach the main vein of the Ready Cash.

The Canterbury tunnel, which is being driven by a local company, organized by the local Chamber of Commerce, for the purpose of exploring Canterbury hill, has broken into the old workings of the Roseville shaft, 1,400 ft. from the portal. Connection with the Roseville shaft marks the first stage of operations in what Leadville people believe is destined to be one of the great mining enterprises of the district. The connection with the old workings assures good air in the tunnel and will enable the management to test the ground for high-grade ore which was popularly supposed to have been discovered in the early days.

Cripple Creek—The big strike on the 2,600 level of the Portland Gold Mining Co. continues to be the leading topic in mining circles. There is also much interest manifested in the several new surface strikes that have been made by prospectors in various parts of the district. The scene of the latest surface strike is on the Axtel claim of the United Gold Mines Co., the location of which is at the little settlement of Midway, where miners for years, going to their work, have tramped over the outcrop.

Georgetown — The most extensive mining enterprise begun in Colorado in the past year, and in actual operation, is that of the East Butte Copper Mining Co. at this place. The project comprised the taking over of the Dives-Pelican-Seven-Thirty groups, the Corey City and the Nashotah mill. Tramways and belt conveyors connect the mill with the several groups and at present about 400 tons of dump material is being handled daily. The plant is being enlarged to treat 500 tons every twenty-four hours. The concentrate is said to run from 150 to 160 oz. in silver and from 15 to 20 per cent lead. The dump material is reduced fifty to one. The flowsheet comprises crushers, rolls, Hardinge mill and Janney flotation units. The saving is said to be 85 per cent of the assay values.

MICHIGAN

The Copper Country

Coal Priority for Northwest Expected to Aid in Replenishing Stocks—Quincy Repairing Shaft Damage

BY M. W. YOUNGS

Houghton—The mines of the Lake district are short of coal for winter operation, some of them not having enough to last until the first of the year, and the decision to give the Northwest priority in coal delivery is counted upon to replenish depleted stocks. It is stated that the coal movement to the Lakes will be started at once and that shipments should reach substantial proportions by mid-September. There are yet three months in which coal may be shipped by water, and there is confidence that the mines will receive sufficient fuel to last them through the winter.

Quincy has three shifts of men at work in No. 6 shaft to repair the damage recently caused by "air blasts," resulting in the crushing of the shaft at certain places where the vein crosses it. The work will be pushed with all possible speed, although it will require six weeks or more to get the shaft in condition for hoisting. It will be necessary to clean out the shaft, remove the rock, and replace the timber, skip rails, and pipe lines. Meanwhile, mining in the lower levels of No. 6 is being done through No. 2 shaft, the lower openings being unaffected by the blasts.

Seneca has awarded a contract for the construction of three miles of track to connect the Seneca and Gratiot shafts with the Mineral Range railroad, over which Seneca rock will be shipped to the Centennial-Allouez mill at Point Mills, in which the Seneca company has an interest. Construction work at Gratiot No. 2 shaft is progressing rapidly, and it is expected that the power and hoisting plants will start before the close of the year. Sinking is about to be resumed in the shaft, which has been rebuilt to the thirteenth or bottom level. Drifting is proceeding on the vein, both at the thirteenth and eleventh levels, and both openings, particularly the thirteenth, are in good ground. The main drifts from the Seneca shaft are being driven northward toward Gratiot at a steady rate, the rock being up to the average of the lode.

Menominee Range

Ore Moving Rapidly—Labor Scarce at Many Mines

Crystal Falls—Many of the mines of the district report a labor shortage, due to the fact that many men have gone to the manufacturing centers. The same condition exists in the lumbering camps. Ore is moving out rapidly from stockpiles and from pockets, and the strikes have had no effect to date. Steam shovels are working at the Carpenter, Monongahela, Porter and Bristol properties. New surface equipment is being installed at the Tobin. The Odgers is developing in a quiet way and shipping the ore hoisted.

THE MARKET REPORT

Daily Prices of Metals

Aug.	Copper, N. Y., net refinery* Electrolytic	Tin 99 Per Cent	Tin Straits	Lead N. Y.	Lead St. L.	Zinc St. L.
10	13.75	31.875	32.125	5.75@5.80	5.525@5.55	6.20@6.25
11	13.75	31.875	32.00	5.75@5.80	5.525@5 55	6.20
12	13.75	31.875	32.25	5.75@5.80	5.525@5.55	6.15@6.20
14	13.75	31.875	32.125	5.75@5.80	5.525@5.55	6.15@6.20
15	13.75	31.875	32.125	5.75@5.80	5.525@5.575	6.15
16	13.75	32.50	32.75	5.75@5.80	5.525@5.575	6.15

*These prices correspond to the following quotations for copper delivered: Aug. 10 to 16th inc., 14c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

Aug.	Copper Standard Spot	Copper Standard 3M	Copper Electrolytic	Tin Spot	Tin 3M	Lead Spot	Lead 3M	Zinc Spot	Zinc 3M
10	64⅛	64¼	70½	159⅛	159⅜	24¾	24	31⅛	30⅛
11	64⅛	64¼	70½	158¾	158½	24⅜	23⅝	30⅞	30
14	64⅛	64¼	70	158¾	158⅞	24½	23¾	31⅛	30¼
15	64	64⅛	70	159	159⅛	24⅜	23¾	31	30¼
16	64¼	64⅜	70¼	160⅛	160¼	24½	23¾	31⅛	30½

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Aug.	Sterling Exchange "Checks"	Silver New York Domestic Origin	Silver New York Foreign Origin	Silver London	Aug.	Sterling Exchange "Checks"	Silver New York Domestic Origin	Silver New York Foreign Origin	Silver London
10	4.45⅜	99⅛	69	34¾	14	4.45¾	99⅛	68½	34½
11	4.45½	99⅛	68¾	34½	15	4.46	99⅛	69⅜	35
12	4.45⅞	99⅛	68⅝	34⅝	16	4.46⅞	99⅛	69⅞	35

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command three-eighths of a cent premium.

Metal Markets

New York, Aug. 16, 1922

No changes of importance have occurred in the metal markets during the last week, and some producers complain of the dullness. Total sales are, however, far in advance of those recorded a year ago, and are really better than might be expected considering the time of year and the railroad and coal strike conditions. The coal strike now seems to be in a fair way to be settled, 10 or 15 per cent of the miners already having come to a satisfactory basis of working conditions. The strike of the railway shopmen is becoming somewhat more serious, but daily conferences are being held looking toward a settlement. With the beginning of the fall season, next month, and providing the labor difficulties are settled by that time, the metal business should be active after the Labor Day holiday on the 4th.

Copper

Copper is about as stable and uniform, at 14c. delivered, as it has been in many weeks. Practically all producers are quoting this figure for all points of delivery except where the freight rate is excessive. Two or three lots have been sold at 13.95c., but we have heard of nothing lower for delivery within the next three months. Business for the first quarter of next year has been considered by one or two interests, and some metal for delivery at that time has been sold at the same levels which have ruled for prompt. Producers in general seem satisfied with the current volume of sales, and it is likely that the month's business will run ahead of that for June and July.

Export demand has been quiet but continued, with orders totaling around 500 or 600 tons a day, well distributed as to destination.

Lead

The official contract price of the American Smelting & Refining Co. continues at the recent level of 5.75c., New York.

Not a great deal of lead has been sold on the New York basis during the week, and most of it has been booked at 5.75c. level. Dealers are, however, quoting as high as 5.90c., and 5.80c.@5.85c. has been paid for small lots, and by consumers who are not regular customers of the producers. Premiums are also asked for forward deliveries by those interests willing to sell on such terms; probably 5.90c.@5.95c. would rule for October-November business. Chemical lead would also command higher prices than 5.75c., since this is sold on the St. Louis basis plus freight to points in the East. This would bring the New York price to 5.90c.

Quotations all the way from 5.52½ to 5.60c. are being made in the St. Louis market. Most of the reported sales have been made on the 5.55c. basis, and there is no tendency today for the price to go either up or down from that level.

Zinc

The market has eased slightly in price, and today it is easy to obtain zinc from practically every producer for 6.15c. It has been rumored that this price has been shaded, but we have no record of any sales below that level, though forward deliveries might be obtained at 6.125c. The coal situation has affected galvanizers, and doubtless has been responsible for the lessened interest in the metal. Zinc is still in an excellent statistical position. The summary of the American Zinc Institute for July shows stocks on hand July 1 of 29,576 tons; production during July of 31,917; shipments, 32,875; stock on hand July 31, 28,618. Shipped during July for export, 541; number of retorts operating at end of month, 54,909. The decrease in stocks was not so large as generally antici-

pated, but further improvement was shown, and the supply on hand is still below a month's consumption.

High-grade zinc has been in excellent demand at 7@7.25c. per lb. delivered.

Tin

Most of the sales of tin during the week have been between dealers, plate mills being virtually out of the market. The scarcity of 99 per cent and Banca grades continues, there being virtually no market and quotations being nominal. Even in London there is said to be no 99 per cent tin available within four weeks. Chinese No. 1 is selling here at about ½c. below straits.

Forward deliveries have commanded about ½c. premium over the prices asked for spot.

Arrivals of tin, in long tons: Aug. 9th, Straits, 30; 10th, London, 125; 14th, Java, 200; Australia, 15; China, 25; Straits, 825; London, 75.

Gold

Gold in London: Aug. 10th, 92s. 6d.; 11th, 92s. 5d.; 14th, 92s. 5d.; 15th, 92s. 4d.; 16th, 92s. 3d.

Foreign Exchange

The foreign exchange market has been steady, with a firm undertone. German marks reached a new low yesterday. A feature of the recent market has been the return of Canadian exchange practically to par. On Tuesday, Aug. 15, francs were 8.035c.; lire, 4.565c.; and marks 0.10c. Canadian dollars 3/32 per cent discount.

Silver

The market continued dull until the 15th, when buying orders from the Indian bazaars and China advanced the price. Continued demand from China, and scarcity of offerings for prompt New York delivery again advanced the local market. At the close the tone of the market is firm.

Mexican Dollars—Aug. 10th, 52¾; 11th, 52½; 12th, 52½; 14th, 52⅝; 15th, 53; 16th, 53⅛c.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—20.10c. per lb. for 99 per cent grade; 19.10c. for 98@99 per cent; 18c. for 94@98 per cent. Outside market nominal at 17.75@18.25c. for 98@99 per cent virgin grades.

Antimony — Chinese and Japanese brands, active and firm at 5.25c. W.C.C., 6@6.25c. Cookson's "C" grade, 7@7.50c.

Bismuth—$2@$2.10 per lb.

Cadmium—$1.20@$1.25 per lb.

Iridium—$185@$195 per oz., New York.

Nickel—Standard market, ingot and shot, 36c.; electrolytic, 39c. Outside market, 31@33c. per lb.

Palladium—$55 per oz.

Platinum—$93 per oz. Strong.

Quicksilver — $57 per 75-lb. flask. Market active. San Francisco wires $56.70. Strong.

Selenium—$1.75@$1.85 per lb.

The prices of **Cobalt, Magnesium, Molybdenum, Monel Metal, Osmium, Rhodium, Thallium and Tungsten** are unchanged from prices given Aug. 5.

Metallic Ores

Manganese Ore—29c. per long ton unit, seaport.

Iron Ore, Chrome, Magnetite, Molybdenum, Tantalum, Titanium, Tungsten, Uranium, Vanadium, and Zircon ore are unchanged from the quotations published Aug. 5.

Zinc and Lead Ore Markets

Joplin, Mo., Aug. 12—Zinc blende, per ton, high, $37.98; basis 60 per cent zinc, premium, $37; Prime Western, $36; fines and slimes, $35@$33; average settling price, all grades of blende, $35.84; calamine, basis 40 per cent zinc, $18.

Lead, high, $81.40; basis 80 per cent lead, $78.50@$80; average settling price, all grades of lead, $79.12 per ton.

Shipments for the week: Blende, 6,887; lead, 2,357; calamine, 29 tons. Value all ores the week, $353,630.

The shipment is near 800 tons in excess of last week, but is not nearly what it would be with cars available for moving the ore. The coal situation has begun to pinch a few of the mines in a small way, but general arrangements for conservation of fuel practiced for months keep the situation well in hand. Shipping is the greatest drawback, with the railroads able to supply only 60 to 80 per cent of the demand.

Platteville, Wis., Aug. 12—Blende, basis 60 per cent zinc, $38 per ton. Lead, basis 80 per cent lead, $80 per ton. Shipments for the week: Blende, 598; lead, none. Shipments for the year: Blende, 10,126; lead, 1,129 tons. Shipped during the week to separating plants, 815 tons blende.

Non-Metallic Minerals

Barytes—Washed crude, 92 per cent $BaSO_4$ guaranteed, $8@$9 per long ton, f.o.b. Georgia points; off-color ground No. 1 grade, $20; No. 2 grade, $15.

Talc—200 to 300 mesh, including containers, $13.50@$14.75, f.o.b. New York state mills. In California, 200 mesh, $16@$18 per short ton; 300 mesh, $25@$30, bags extra at cost.

Asbestos, Bauxite, Borax, Chalk, China Clay, Emery, Feldspar, Fluorspar, Fuller's Earth, Graphite, Gypsum, Limestone, Magnesite, Mica, Monazite, Phosphate, Pumice, Pyrites, Silica, and Sulphur are unchanged from the prices published Aug. 5.

Mineral Products

Arsenious Oxide (white arsenic)—8c. per lb.

Copper Sulphate—Large crystals, 6.50c. per lb.

Sodium Nitrate—$2.25@$2.65 per 100 lb., ex vessel Atlantic ports.

July exports of nitrate are in excess of those effected during the month of June, according to *Commerce Reports*, and the fact that sales of the nitrate association for future delivery subsequent to June 30 now approximate 500,000 tons presages increased exports during the coming months. A rumor is current that Germany is negotiating for 600,000 tons to supply a shortage resulting from its deficient production of synthetic nitrate.

Potassium Sulphate and **Sodium Sulphate** are unchanged from quotations of Aug. 5.

Ferro-Alloys

Ferrocerium, Ferrochrome, Ferromanganese, Ferromolybdenum, Ferrosilicon, Ferrotitanium, Ferrotungsten, Ferro-uranium, and Ferrovanadium are unchanged from the prices published Aug. 5.

Metal Products

Copper Sheets—New York base, 21c. per lb.; wire, 15.50@15.75c. net.

Nickel Silver—28c. per lb., for 18 per cent nickel Grade "A" sheets.

Yellow Metal—Dimension sheets, 18.75c.; rods, 15.75c. per lb.

Lead Sheets are unchanged from the quotations published in the Aug. 5 issue.

Zinc Sheets — 7.75c. per lb., f.o.b. smelter.

Refractories

Magnesite Brick—$56 per net ton.

Magnesite Cement — $35@$40 per ton.

Silica Brick—$33@$41 per 1,000, f.o.b. shipping points.

Bauxite Brick, Chrome Brick, Chrome Cement, Firebrick, and Zirkite are unchanged from the prices appearing in the issue of Aug. 5.

The Iron Trade

Pittsburgh, Aug. 15, 1922

Production of steel continues to decline, on account of the railroad and coal strikes. In four months of the coal strike, April to July inclusive, there was heavy production of steel, and it is probable that some stocks have accumulated in buyers' hands.

Mills as a rule are very well filled with business and will have little steel to sell for delivery in the remainder of the year. Basis prices, apart from prices asked for early deliveries, continue to rise and are approaching if they have not reached a level too high to be sustained when ordinary competitive conditions between mills are restored. Bars, shapes and plates are at a minimum of 1.80c., an advance of $2 a ton in the week and of $4 a ton within thirty days. The 3.15c. basis on sheets has become nominal, sales being usually at 3.30c. or 3.40c.

Pig Iron—There is only a prompt market, which has advanced about $1 in the week, last sales of bessemer being at $27, of foundry at $28, of malleable at $29, and of basic at $25.50, all at Valley furnaces, with $1.77 freight to Pittsburgh.

Connellsville Coke—The current turnover is light. Furnace, $14@$14.50; foundry, $15@$15.50.

Use of Lead Is Increasing

Manufacturers' Demand for Metal Continues Strong and Indicates Return to Normal Industrial Conditions—Production Gradually Increasing in Rocky Mountains—Statistical Position Excellent

By Felix Edgar Wormser
Assistant Editor, *Engineering and Mining Journal-Press*

THE PRICE OF LEAD is high because a strong demand exists for that metal. Practically all lead-mining companies report heavier sales of lead this year than last. One of them, to illustrate this point, has kindly supplied the interesting information given below. This company is one of the largest lead producers in the United States—in the world, for that matter. From a record of lead deliveries of the company for the first six months of 1922 it appears that compared with 1921 the following changes have taken place:

Manufacturers	Change in Volume of Deliveries
White lead	No change
Mixed metals	Increased 45 per cent
Ammunition	Increased 45 to 50 per cent
Lead-covered cable	Increased 65 per cent
Lead pipe and plumbing	Increased 20 to 25 per cent
Foil	Increased 60 per cent
Retail metal dealers	Increased 50 per cent
Storage batteries	Increased 40 per cent

The spectacular increases in some consuming branches may create misleading conclusions unless the abnormality of business conditions in 1921 is considered. Last year the consumption for white lead was normal, and this state of trade has evidently continued for the first six months of 1922. On the other hand, many of the other lead-consuming industries were operating below normal in 1921, at from 50 to 70 per cent of capacity, so that the increases indicated above merely bring these industries back to 85 to 100 per cent of normal. Even so, it is interesting to note that almost the entire lead-consuming trade is getting on its feet again. The large increase in foil consumption bears out a remark made many months ago to the effect that lead foil and metallic foil in general are regaining the popularity they lost during the war when the use of substitutes was encouraged.

Manufacturers Buying Lead to Fill Orders

Consumers are carrying moderate stocks at their plants and only sufficient quantities to take care of current requirements. Their purchases of lead have generally represented actual sales of manufactured goods. The monthly supply of lead has not been sufficiently large to meet this demand, and producers have had to draw upon reserve stocks, a step that only partly stemmed the rising price of the metal. Price has been a secondary consideration to the industries purchasing the metal. Building construction and automobile manufacture, two trades unusually active at the present time, are important outlets for lead—one uses it as paint, and for plumbing, the other chiefly in storage batteries and bearing metals.

Statistically the position of lead remains excellent. Stocks of refined lead in the hands of producers are about six weeks' consumption, which, at its present rate, is estimated at 10,000 tons per month greater than the present output. The high price of lead, 5.75c. per lb., New York, has stimulated production, which is expected to increase further, and at present is estimated at 35,000 tons monthly. Announcement has been made that the Hercules and Tamarack and Custer mines, in the Coeur d'Alenes, in Idaho, have resumed operations. Both of these mines are important large-scale operations. The Hercules is one of the bonanza silver-lead mines of the Coeur d'Alenes. It is splendidly equipped and can produce about 175,000 tons of ore per year. Its milling-grade ore runs about 10 per cent in lead and averages 8 to 9 oz. in silver per ton, while the production of crude may run 40 to 55 per cent in lead and 45 oz. in silver. Roughly 15,000 tons of crude ore is usually shipped annually.

Under a recent arrangement concluded with the American Smelting & Refining Co. the output of the Tamarack and Custer and the Hercules mines is to be smelted at the East Helena smelter of the Smelting company. This means the abandonment of the Northport smelter, closed for several years, which was rebuilt to handle the output of those two mines, but has proved costly in operation.

Changes in Coeur d'Alene Smelting Arrangements

The smelting of the Coeur d'Alene lead-silver ore output is now principally handled by only two smelters, that of the American Smelting & Refining Co. at East Helena, which is largely dependent upon custom ores for its output, and that of the Bunker Hill & Sullivan Mining & Concentrating Co. at Bradley, Idaho. Owing to an old contract, part of the Bunker Hill mine production is still shipped to the East Helena smelter. The expiration of this contract will leave a void in that plant compensated by the new contracts with the Hercules and the Tamarack and Custer. At the same time the smelter at Bradley will be able to increase its output, which is at present far below maximum. Mining and smelting in the Coeur d'Alenes in the past has been characterized by an unfortunately large amount of litigation both among the various companies and within the various units operating there. This has naturally retarded the most efficient and steady development of the district.

The Bunker Hill output is now being sold under a new contract by the St. Joseph Lead Co., and although this arrangement increases the variety and amount of metal for sale by the St. Joseph Co., that producer, contrary to some recently published statements, still ranks below the American Smelting & Refining Co. in point of tonnage. In 1921 the American Smelting & Refining Co. produced 207,612 tons, St. Joseph Lead Co. 70,948 tons, and Bunker Hill 42,000 tons. The lead production of the entire country last year amounted to 457,000 tons from all sources.

Although an active consuming demand is at heart responsible for the rise in the price of lead, the high protection which the market will probably be given under the new tariff law may have been discounted and reflected in the advance. The tariff should assure producers of being able to retain a good measure of the gain in price.

Lead Price Reasonable

It is noteworthy that the lead market has advanced slowly in price, with the possible exception of the advance in April. Several times during the rise it would have been an easy matter for producers to have demanded even higher prices for their product, but it is characteristic of the method in which lead is sold to make only small changes in price and then only after careful consideration of the position of the metal and the ability of the market to stand an increase. The market is rarely, if ever, on a basis on which only one or two producers are willing to trade.

At 5.75c. per lb. New York, lead may seem unduly expensive in comparison with a pre-war five-year average of 4.40c., but as the average commodity price level is still 50 to 70 per cent above the pre-war period, lead is selling only at an eminently fair rate. The outlook is excellent for a continuation of the market at the present level or near it. European buying of foreign lead has been heavy, and Mexican lead has had a splendid market open to it abroad. Production the world over is increasing, but not rapidly enough to affect prices. A labor shortage is not only hampering operations in the United States but in other countries as well.

COMPANY REPORTS

The Plymouth Consolidated Gold Mines, Ltd.

Gold: California

A report of operations of the Plymouth Consolidated Gold Mines, Ltd., for 1921 shows a loss of £16,203 6s. 7d. Profit and loss account follows:

	£	s.	d.	£	s.	d
To working expenses, California						
Development	15,821	14	4			
Mining	71,389	6	10			
Milling	17,893	11	7			
Realization of bullion and concentrates	7,447	9	2			
Maintenance and general expenses	6,412	3	3			
				118,964	5	2
General expenses, London				1,692	19	7
American taxes				1,546	15	7
Difference on exchange				789	10	7
				£122,993	10	11
				£	s.	d.
By sales of bullion and concentrates				111,721	4	8
Rents				431	11	8
Interest				734	0	8
Transfer fees				7	10	0
Balance, loss carried down				10,099	3	11
				£122,993	10	11

	£	s.	d.	£	s.	d.
To balance, brought down				10,099	3	11
Depreciation of machinery, plant, buildings, etc.				2,000	0	0
Depreciation of investments				2,291	9	0
Income tax	2,186	0	0			
Corporation profits tax	265	9	0			
				2,451	9	0
				£16,842	1	11
By balance, brought forward from last account				£638	15	4
Balance, carried forward				16,203	6	7
				£16,842	1	11

Balance sheet as of Dec. 31, 1921, is as follows:

Liabilities	£	s.	d.	£	s.	d.
Share Capital						
Authorized 240,000 shares of £1 each	240,000	0	0			
Issued 240,000 shares of £1 each fully paid				240,000	0	
Sundry creditors				22,522	2	6
(for outstanding dividends)				8	5	4
				£262,530	7	10

Assets	£	s.	d.	£	s.	d.
Property account as at Dec. 31, 1920				200,150	3	11
Machinery, plant, buildings, etc.						
As at Dec. 31, 1920	12,000	0	0			
Additions during the year	2,885	16	0			
	14,885	16	0			
Less depreciation	2,000	0	0			
				12,885	16	0
Office furniture at mine				52	11	2
Stores on hand				15,243	12	8
Investments, at cost, less depreciation war loan, etc.				14,311	6	3
Sundry debtors and insurance unexpired				1,308	8	8
Cash at bank and in hand						
London	872	3	3			
California	1,502	19	4			
				2,375	2	7
Profit and loss account				16,203	6	7
				£262,530	7	10

Total tonnage milled during the year was 102,000 tons yielding 25,940.46 oz. of gold and 6,701.11 oz. of silver. Extraction was 88.95 per cent. Total cost per ton milled was 23s. 3.91d.

Chief Consolidated Mining Co.

Silver, lead; Utah

A report of operations of the Chief Consolidated Mining Co. for the first quarter of 1922 shows a net profit of $190,087.06 after payment of all charges. The total shipments of ore were 25,628 dry tons yielding, after smelting, transportation and sampling charges, $766,909.81. Metal contents were 1,061 oz. gold, 1,055,893 oz. silver, 3,777,984 lb. lead and 8,434 lb. copper.

Oroville Dredging Co., Ltd.

Gold; Colombia

A report of operations of the Oroville Dredging Co., Ltd., for the year ended Sept. 30, 1921, states that the liquidation of the American Oroville Co. has now been completed.

On the assets side of the balance sheet the 125,993 ordinary shares of 10s. each, fully paid, in Nechi Mines (Colombia), Ltd., and 255,000 ordinary shares of Colombian Corporation, Ltd., shown in the last report, are still held. The company's total holding of shares of £1 each, fully paid, in Pato Mines (Colombia), Ltd., has been increased to 89,227.

During the year dividends were received from the company's holding of shares in Nechi Mines (Colombia), Ltd., amounting to £62,996 10s., and in Pato Mines (Colombia), Ltd., to £93,616 5s., the other credits in the profit and loss account amounting to £1,449 13s. 1d. From the total credits of £158,062 8s. 1d., after debiting all charges in London, the balance to credit of profit and loss account for the year is £144,785 4s. 3d., compared with £111,829 5s. 10d. for the previous year. Adding to this amount the credit balance from last year of £42,797 13s. 9d., a total is shown of £187,582 18s. Deducting from this four dividends of 9d. per share on Dec. 30, 1920, March 31, June 30, and Sept. 30, 1921, and one of 1s. per share on July 27, 1921, amounting to £137,307 12s. 0d., a balance of £50,275 6s. 9d. remained to the credit of profit and loss account as at Sept. 30, 1921, subject to excess profits duty (if any) and corporation profits tax.

In his annual report of field operations to Sept. 30, 1921, the general manager of the Pato company, W. A. Prichard, states that 1,555,937 cu.yd. was dredged, as compared with 1,437,600 for the previous year, the gross value of the gold recovered being $608,511, averaging 39.1c. per cu.yd., with an average depth of gravel dredged of 33.1 ft., against $526,267, averaging 36.6c. for the previous year, with an average depth of 29.2 ft. The field cost for the year averaged 11.33c. per cu.yd., as compared with 8.92c. for the previous year.

It is reported that 2,628,684 cu.yd. was dredged from the Nechi company's ground during the year, as compared with 2,135,084 for the previous year, the gross value of the gold recovered being $653,088, averaging 24.8c. per cu.yd. with an average depth of gravel dredged of 43.9 ft., against $815,188 averaging 38.2c. for the previous year with an average depth of 50.8 ft. The field cost averaged 6.40c. per cu.yd., as compared with 7.14c. for the previous year. With the addition of the £1,000 per month rental to the Pato company for the use of its plant, and the proportion of management expense charged to the Nechi company's account in the London books, plus depreciation, the total operating cost for the financial year to Sept. 30, 1921, amounts to 10.03c. per cu.yd., compared with 11.71c. for the previous year.

New Jersey Zinc Co.

A statement of operations of the New Jersey Zinc Co. for the quarter ended June 30, 1922, follows:

Income (including dividends from subsidiary companies) after deductions for expenses, taxes, maintenance, repairs, betterments, depreciation and contingencies		$1,637,161.16
Deduct interest on first mortgage bonds		40,000.00
Net income		$1,597.161.16
Deduct:		
Interest on stock subscriptions	$10,516.13	
Dividend 2 per cent, payable Aug. 10, 1922	964,706.00	975,222.13
Surplus for the quarter		$621,939.03

MINING STOCKS

Week Ended Aug. 12, 1922

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Ahmeek	Boston	64½	63	64½	Aug. '22, Q	$1.00
Alaska-Br. Col. new.	N. Y. Curb	2½	2⅜	2⅜	.....	....
Allouez	Boston	26	25	25	Mar. '19	1.00
Anaconda	New York	54⅜	53⅜	53½	Nov. '20, Q	1.00
Arcadian Consol.	Boston	3⅞	3⅜	3½	.....	....
Ariz. Com'l	Boston	†9½	†8⅜	8⅞	Oct. '18, Q	0.50
Big Ledge	N. Y. Curb	*11	*8	*9	.....	....
Bingham Mines	Boston	†14⅜	†14⅛	14½	Sept. '19, Q	0.25
Calumet & Arizona	Boston	61⅜	60½	60⅞	June '22, Q	0.50
Calumet & Hecla	Boston	295	288	295	Aug. '22, Q	5.00
Canada Copper	N. Y. Curb	*18	*7	*8	.....	....
Centennial	Boston	†10	†9	9½	Dec. '18, SA	1.00
Cerro de Pasco	New York	40⅛	38½	39¼	Mar. '21, Q	0.50
Chile Copper	New York	22⅛	21⅛	22⅛	.....	....
Chino	New York	30⅛	29⅛	29⅝	Sept. '20, Q	0.37½
Columbus Rexall	Salt Lake	*33	*28	*28½	.....	....
Con. Arizona	N. Y. Curb	....	....	*3	Dec. '18, Q	0.05
Con. Copper Mines	N. Y. Curb	*60	*40	*45	.....	....
Copper Range	Boston	43⅜	42⅛	43⅛	Mar. '22, Q	1.00
Crystal Copper	Boston Curb	1 1/16	1 1/16	1 1/16	.....	....
Davis-Daly	Boston	8	7½	7½	Mar. '20, Q	0.25
East Butte	Boston	11	10⅛	10½	Dec. '19, A	0.50
First National	Boston Curb	*60	*55	*55	Feb. '19, SA	0.15
Franklin	Boston	2⅜	2⅛	2⅛	.....	....
Gadsden Copper	Boston Curb	85	80	80	.....	....
Granby Consol.	New York	32⅜	29⅜	31⅛	May '19, Q	1.25
Greene-Cananea	New York	31	30⅜	30⅞	Nov. '20, Q	0.50
Hancock	Boston	2	2	2	.....	....
Howe Sound	N. Y. Curb	3	3	3	Jan. '21, Q	0.05
Inspiration Consol.	New York	41⅛	40⅛	41⅛	Oct. '20, Q	1.00
Iron Cap	Boston Curb	7⅞	7⅛	7⅞	Sept. '20, K	0.25
Isle Royale	Boston	25	22	25	Sept. '19, SA	0.50
Kennecott	New York	37⅛	36	36⅝	Dec. '20, Q	0.50
Keweenaw	Boston	3	2⅛	2⅛	.....	....
Lake Copper	Boston	4⅜	4⅛	4⅛	.....	....
La Salle	Boston	1⅜	1⅛	1⅛	.....	....
Magma Copper	N. Y. Curb	28⅛	27⅛	27⅞	Jan. '19, Q	0.50
Majestic	Boston Curb	*5	*5	*5	.....	....
Mason Valley	Boston	2	2	2	.....	....
Mass. Consolidated	Boston	3⅛	2⅜	2⅜	Nov. '17, Q	1.00
Miami Copper	New York	29⅝	29⅛	29⅛	May '22 Q	0.50
Michigan	Boston	3	2⅜	2 3/16	.....	....
Mohawk	Boston	63	60⅛	61	July '22, Q	1.00
Mother Lode Coa.	N. Y. Curb	11	9⅜	11	June '22, I	0.50
Nevada Consol.	New York	17⅛	16¼	16⅜	Sept. '20, Q	0.25
New Cornelia	Boston	19¼	19	19⅛	May '22, K	0.25
North Butte	Boston	13½	12⅜	12⅞	Oct. '18, Q	0.25
North Lake	Boston	....	....	⅜	.....	....
Ohio Copper	N. Y. Curb	....	....	*8	.....	....
Old Dominion	Boston	26	25⅛	26	Dec. '18, Q	1.00
Osceola	Boston	37⅛	36	36⅛	Aug. '22, Q	1.00
Phelps Dodge	Open Mar.	†175	†160	...	July '22, Q	1.00
Quincy	Boston	45	43⅛	43⅞	Mar. '20, Q	1.00
Ray Consolidated	New York	16⅛	16⅛	16⅛	Dec. '20, Q	0.25
Ray Hercules	N. Y. Curb	1⅜	1⅛	1⅛	.....	....
St. Mary's Min. Ld.	Boston	48	47	48	Apr. '22, K	2.00
Seneca Copper	Boston	12	12	12	.....	....
Shannon	Boston	*90	*85	*90	Nov. '17, Q	0.25
Shattuck Arizona	New York	10⅛	10	10⅛	Jan. '20, Q	0.25
South Lake	Boston	†1⅛	†*95	1	.....	....
Superior & Boston	Boston	1 1/16	1⅛	1⅛	.....	....
Tenn. C. & C. cfs.	New York	10⅛	9⅝	10	May '18, I	1.00
Tuolumne	Boston	*75	*69	*69	May '13,	0.10
United Verde Ex.	Boston Curb	28	27	27	Aug. '22, Q	0.25
Utah Consol.	Boston	2⅞	2⅜	2⅜	Sept. '18,	0.25
Utah Copper	New York	66	64⅞	66	June '22, Q	0.50
Utah Metal & T.	Boston	1⅛	1	1⅛	Dec. '17,	0.30
Victoria	Boston	1 1/16	1⅛	1⅛	.....	....
Winona	Boston	1⅛	1⅛	1⅛	.....	....
Wolverine	Boston	12⅛	11	12	.....	....
NICKEL-COPPER						
Internat. Nickel	New York	18⅛	17⅛	17⅛	Mar. '19,	0.50
Internat. Nickel, pfd	New York	†83	†80	83½	Aug. '22, Q	1.50
LEAD						
National Lead	New York	100⅜	99	100	June '22, Q	1.50
National Lead, pfd.	New York	113	111⅛	113	June '22 Q.	1.75
St. Joseph Lead	New York	15⅛	15¼	15¼	June '22, Q	0.25
QUICKSILVER						
New Idria	Boston	†*15	†*15	*10	.....	....
ZINC						
Am. Z. L. & S.	New York	18⅜	17⅛	17⅛	May '20,	1.00
Am. Z. L. & S. pfd.	New York	47½	46	46	Nov. '20, Q	1.50
Butte C. & Z.	New York	7⅜	7⅛	7⅛	June '18,	0.50
Butte & Superior	New York	31	29⅜	30	Sept. '20,	1.25
Callahan Zn-Ld.	New York	8½	8	8⅛	Dec. '20, Q	0.50
New Jersey Zn.	N. Y. Curb	144½	144½	144½	Aug. '22, Q	2.00
Yellow Pine	Los Angeles	*55	*55	*55	Sept. '20, Q	0.03

*Cents per share. †Bid or asked. Q, Quarterly. SA, Semi-annually. M Monthly. K, Irregular. I, Initial. X, Includes extra.

Toronto quotations courtesy Hamilton B. Wills; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Commerce and Oil; Colorado Springs, The Financial Press, N. Y.

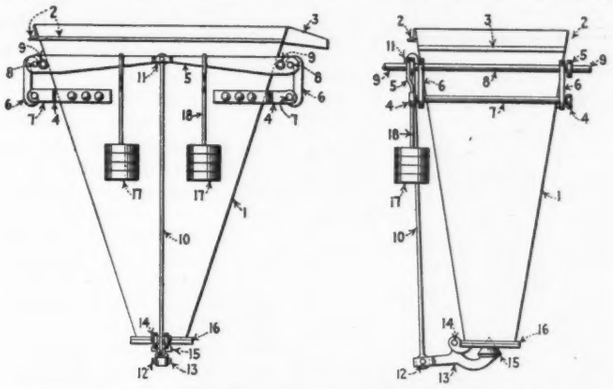
Stock	Exch.	High	Low	Last		Last Div.
GOLD						
Alaska Gold	New York	⅜	⅜	⅜	.....	....
Alaska Juneau	New York	1⅛	1⅛	1⅛	.....	....
Atlas	Toronto	*28½	*27	*28	.....	....
Carson Hill	New York	†11	†9⅜	10½	.....	....
Cresson Consol. G.	N. Y. Curb	2⅞	2⅛	2⅞	July '22, Q,X	$0.10
Dome Mines	New York	33⅜	31⅛	32⅛	July '22, Q	.50
Florence Goldfield	N. Y. Curb	*12	*12	*12	.....	....
Golden Cycle	Colo. Springs	1.02½	*98	*98	June '21, Q	0.02
Goldfield Consol.	N. Y. Curb	*7	*7	*7	Dec. '19,	0.05
Gordon Murray	Toronto	....	....	*30	.....	....
Hollinger Consol.	Toronto	11.90	10.31	11.35	Aug. '22,	0.05
Homestake Mining	New York	70	70	70	July '22, M	0.25
Keora	Toronto	*13½	*11	*12½	.....	....
Kirkland Lake	Toronto	*41	*36	*40	.....	....
Lake Shore	Toronto	2.43	2.32	2.40	Nov. '21, K	0.02
McIntyre-Porcupine	Toronto	19.10	18.85	19.00	May '22, K	0.05
Porcupine Crown	Toronto	*26	*25	*25½	July '17,	0.03
Porcupine V. N. T.	Toronto	*20½	*17	*17½	.....	....
Portland	Colo. Springs	*40	*35	*35	Oct. '20, Q	0.01
Schumacher	Toronto	*74½	*72	*74	.....	....
Silver Pick	N. Y. Curb	*9	*8	*9	.....	....
Teck Hughes	Toronto	*70	*67½	*68	.....	....
Tom Reed	Los Angeles	*89	*65	*76	Dec. '19,	0.02
United Eastern	N. Y. Curb	1 1/16	1 1/16	1 1/16	July '22, Q	0.15
Vindicator Consol.	Colo. Springs	*6	*4	*6	Jan. '20, Q	0.01
White Caps Mining	N. Y. Curb	*8	*7	*8	.....	....
Wright-Hargreaves	Toronto	3.50	3.00	3.50	July '22,	0.02½
Yukon Gold	N. Y. Curb	*92	*92	*92	June '18,	0.02½
SILVER						
Batopilas Mining	New York	⅜	⅜	⅜	Dec. '07, I	0.12½
Beaver Consol.	Toronto	*31	*29	*30	May '20, K	0.03
Coniagas	Toronto	1.35	1.35	1.35	May '21, Q	0.12½
Crown Reserve	Toronto	*28	*24	*25	Jan. '17,	0.05
Kerr Lake	N. Y. Curb	4	3⅜	3⅜	July '22, Q	0.12½
La Rose	Toronto	*31	*27	*31	Apr. '22,	0.10
McKinley-Dar.-Sav.	Toronto	*24	*23	*23	Oct. '20, Q	0.03
Mining Corp. Can.	Toronto	1	*90	*95	Sept. '20, Q	0.12½
Nipissing	N. Y. Curb	6	5⅛	5⅛	July '22, Q, X	0.30
Ontario Silver	New York	7	7	7	Jan. '19, Q	0.50
Ophir Silver	N. Y. Curb	...	...	*12	Jan. '12,	0.10
Temiskaming	Toronto	*34	*31	*33	Jan. '20, K	0.04
Trethewey	Toronto	*4½	*4	*4	Jan. '19,	0.05
GOLD AND SILVER						
Boston & Montana	N. Y. Curb	*18	*16	*17	.....	....
Cash Boy	N. Y. Curb	*8	*6	*8	.....	....
Dolores Esperanza	N. Y. Curb	2⅛	2⅛	2½	July '22,	2.50
El Salvador	N. Y. Curb	*3	*3	*3	.....	....
Jim Butler	N. Y. Curb	...	...	*6	Aug. '18, SA	0.07
Jumbo Extension	N. Y. Curb	...	...	*4	June '16,	0.05
MacNamara M.&M.	N. Y. Curb	*8	*7	*8	May '10,	0.02½
Tonopah Belmont	N. Y. Curb	1 1/16	1⅛	1⅛	July '22, Q	0.05
Tonopah Divide	N. Y. Curb	*72	*63	*66	.....	....
Tonopah Extension	N. Y. Curb	1 1/16	1⅛	1⅛	July '22, Q	0.05
Tonopah Mining	N. Y. Curb	2	1⅞	1⅞	Apr. '22, SA, X	0.07½
West End Consol.	N. Y. Curb	1⅛	1	1⅛	June '22, SA	0.05
SILVER-LEAD						
Caledonia	N. Y. Curb	*8	*8	*8	Jan. '21, M	0.01
Cardiff M. & M.	Salt Lake	†*80	†*70	*70	Dec. '20,	0.15
Chief Consol.	Boston Curb	5	5	5	May '22, Q	0.05
Consol. M. & S.	Montreal	25⅛	25¼	25¼	Oct. '20, Q	0.62½
Daly Mining	Salt Lake	†3.00	†1.90	...	July '20, Q	0.10
Daly-West	Boston	...	...	1⅛	Dec. '20, Q	0.25
Eagle & Blue Bell	Boston Curb	2⅛	2⅛	2⅛	Apr. '21, K	0.05
Electric Point	Spokane	*4⅛	*4	*4	May '20, SA	0.03
Federal M. & S.	New York	14	14	14	Jan. '09,	1.50
Federal M. & S. pfd.	New York	54⅞	53⅛	53⅛	June '22, Q	1.25
Florence Silver	Spokane	*35	*35	*35	Apr. '19,	0.01½
Grand Central	Salt Lake	†*65	†*60	*61	Jan. '21, K	0.01
Hecla Mining	N. Y. Curb	7⅛	6⅛	7⅛	June '22, Q	0.15
Iron Blossom Con.	N. Y. Curb	...	...	*31	Apr. '22, Q	0.02½
Judge M. & S.	Salt Lake	3.40	3.40	3.40	Sept. '20, Q	0.12½
Marsh Mines	N. Y. Curb	*14	*10	*10	June '21, I	0.02
Prince Consol.	Salt Lake	*7½	*7	*7½	Nov. '17,	0.02½
Rambler-Cariboo	Spokane	*5	*5	*5	Feb. '19,	0.01
Rex Consol.	N. Y. Curb	*10	*7	*10	.....	....
Standard Silver-Ld.	N. Y. Curb	*19	*18	*19	Oct. '17,	0.05
Stewart Mines	N. Y. Curb	*7	*6	*6	Dec. '15,	0.05
Tamarack-Custer	Spokane	3.25	3.00	3.20	Jan. '21, K	0.04
Tintic Standard	Salt Lake	1.97½	1.92½	1.92½	Dec. '21, Q	0.05
Utah Apex	Boston	2⅛	2⅛	2⅛	Nov. '20, K	0.25
Wilbert Mining	N. Y. Curb	...	...	*8	Nov. '17,	0.01
VANADIUM						
Vanadium Corp.	New York	50⅜	48⅛	49⅜	Jan. '21, Q	1.00
ASBESTOS						
Asbestos Corp.	Montreal	62½	62	62	July '22, Q	1.50
Asbestos Corp. pfd.	Montreal	82½	82	82	July '22, Q	1.75
SULPHUR						
Freeport, Texas	New York	21⅜	20	20	Nov. '19, Q	1.00
Texas Gulf	New York	48⅜	48	48⅛	June '22, QX	1.00
MINING, SMELTING AND REFINING						
Amer. Sm. & Ref.	New York	61⅜	60	60⅜	Mar. '21, Q	1.00
Amer. Sm.& Ref. pf.	New York	98½	98	98	June '22 Q	1.75
Am. Sm. Sec. pf. A.	New York	96	95½	96	July '22, Q	1.50
U. S. Sm. R. & M.	New York	41⅛	41⅛	41⅛	Jan. '21, Q	0.50
U.S. Sm.R.& M. pf.	New York	48½	48⅜	48½	July '22, Q	.87½

NEW MACHINERY AND INVENTIONS

The Wood Gravity Classifier

Higher Efficiency and Lower Cost Claimed—Agitation Obtained by Flow of Feed—Settling Capacity Adjusted Automatically

The Wood gravity classifier is a machine designed to separate sand particles in water according to the size of the particle. The classifying action is obtained by the free settling of the coarser particles in a chamber of constant capacity and the overflow of the finer particles. This chamber is formed by the upper part of a hopper or cone into which the pulp to be classified is constantly fed. The lower part of this hopper is occupied by the bed made up of the coarser sand particles as they settle. This bed of coarse sand, the oversize of the operation, is drawn off through a valve in the vortex of the cone or hopper, which valve is automatically operated by any variation of the weight in the hopper in the following manner:



Details of Wood gravity classifier.—1. *Sheet iron hopper.* 2. *Angle iron rim.* 3. *Overflow lip.* 4. *Supporting arm.* 5. *Lever.* 6. *Supporting link.* 7. *Arm cross-member.* 8. *Lever cross-member.* 9. *Lever fulcrum.* 10. *Valve rod.* 11. *Valve rod pivot.* 12. *Lower valve rod pivot.* 13. *Valve lever.* 14. *Valve lever pivot.* 15. *Valve.* 16. *Bottom plate.* 17. *Counter balance weights.* 18. *Counter balance weight rod.*

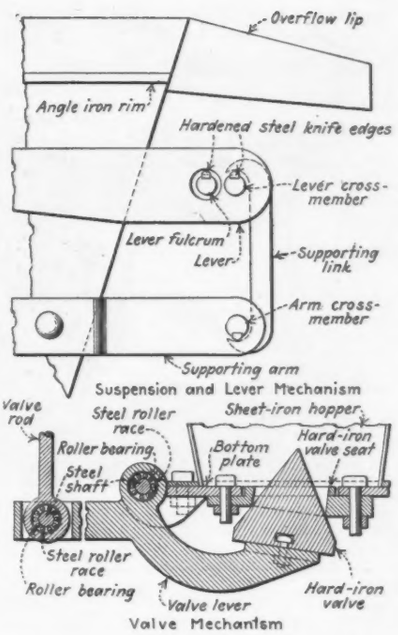
The entire weight of the hopper and its contents is carried on two levers so arranged that they form a scale on which the contents of the hopper is constantly being weighed. These levers are counter-balanced with adjustable weights to hold any required amount of bed in the hopper. The end of each lever has bearing on a rod connected with a third lever at the bottom of the hopper, on which lever is mounted the oversize discharge valve. These levers are simply arranged so that an increase in weight in the hopper opens the valve and a decrease in weight closes it.

The principle of this classifier can be compared directly with that of mechanically operated classifiers. They all have a settling chamber from which the particles too small to settle to the bed overflow with most of the water. The particles large enough to settle into this bed are drawn off from the bottom by one means or another. The sizes of the products depend on the settling capacity of this chamber, or on the amount of time they have in which to settle to the bed before they are drawn off in the overflow. The uniformity of the products depends on the uniformity of the agitation in this chamber. In the Wood gravity classifier the adjustment and maintainance of this settling capacity is simple, positive, and automatic. The agitation, obtained by the flow of feed into the hopper, is far more uniform than in the ordinary mechanical classifiers in which part of the water in the settling chamber is comparatively quiet.

The Wood classifier, it is claimed, can be used for any classifying operation within the range of hydraulic classifying or mechanical-hydraulic classifying. When it is used for ball-mill oversize return, for concentrating-table feed classification, for dewatering tailings before stacking or conveying them, for removing colloids or slimes, for thickening or regulating flotation feed or for removing coarse sand from Dorr thickener feed, the most satisfactory results are obtained. The classifier can be built in any practical shape to suit particular needs. It can be built small enough for laboratory use or large enough to offer several thousand square feet of surface. It has a large range and capacity.

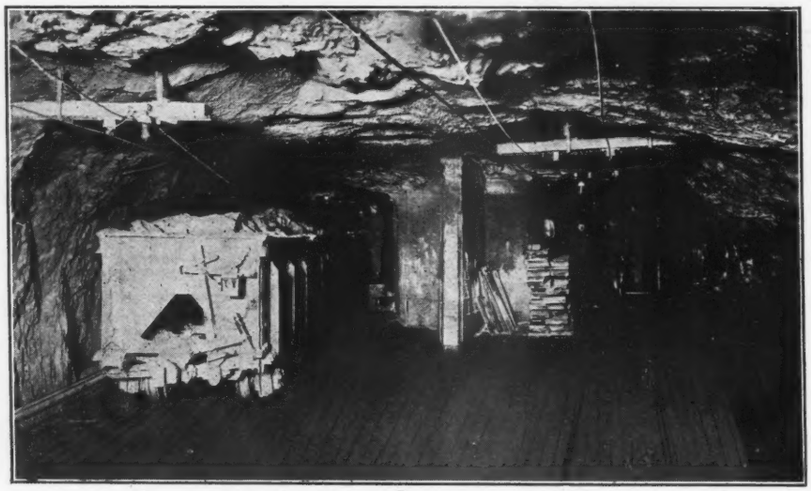
Little information of general interest can be given on classifying efficiency without many figures, because of the large variety of conditions and requirements. However, the inventor will gladly furnish the results of tests already made on similar operations or careful estimates on what could be done in other cases. An efficiency of from 70 per cent to 90 per cent has been obtained on a variety of operations.

The dewatering ability of this machine depends on the per cent of voids in a bed of any particular material under the pressure of as many feet as the hopper is deep. This varies with the nature of the oversize product and the size of the hopper, but it is safe to say that the moisture content of the oversize product in all cases would be between 25 per cent and 40 per cent.



Two advantages are claimed for the Wood classifier over other classifiers, namely, higher efficiency and lower cost. The efficiency attained by the principle of the machine is maintained by the mechanical details. Its action is said to be almost frictionless, as the weight is supported on four knife-edges and the other moving parts have lubricated bearings, with roller bearings where there is the most motion. The lever cross-members are welded into the levers making two rigid, U-shaped pieces which cannot get out of line. The levers on one side of the machine are short and do not connect. On large machines these levers carry part of the counter-balance weight to relieve the torsion in the lever cross-member. The levers on the other side of the hopper overlap and are connected by a pin fastened firmly into one lever and extending through a slot in the other lever. The counterbalance weights on these levers are readily moved along the lever to change the amount of bed carried in the hopper when desirable.

The entire valve consists of the valve lever, the valve and the valve seat. The valve and the valve seat are cast of hard iron to resist the abrasion of the coarse sand. The valve is so designed that the valve proper seats with its axis at right angles to the plane of the valve seat, and opens on an arc, the tangent of which is at right angles to the valve seat. This arrangement insures an annular opening of as near the same width on each side at all times as is possible. Another feature of the valve lever is the location of the end bearing below the level of the pivot bearing, thus slightly increasing the leverage of this end of the lever to counteract the impact of



Main level station at the Negaunee mine of the Cleveland-Cliffs Iron Co., Negaunee, Mich. The 65-cu.ft. cars shown at the left are of Lake Shore Engine Works, Marquette, Mich., manufacture

the stream on the valve when it is open.

The simplicity of the machine is apparent. Such repairs as are necessary are easily and quickly made. It requires almost no attention from the operator. Its adjustment does not have to be changed in starting up or shutting down.

The first cost of the Wood classifier can be stated accurately only on the estimation of the particular machine required. The cost of installation is low. The fulcrum bars can either rest on timbers or be suspended from timbers above by means of eye-bolts.

It is claimed that the cost of operation is small. For installations where the material handled is coarse, hard and sharp, the hopper is provided with holes for fastening the liners. In a machine handling forty-five tons per hour of minus ¾-in. flint a set of No. 12 sheet-iron liners will handle about 400,000 tons of material. The hard-iron valve and valve seat will handle upward of 35,000 tons of material before they need to be replaced. The valve lever is protected from wear by a sheet-iron clip slipped over it.

No new principle is claimed for this machine. Its features, as claimed by the inventor, may be summarized as follows: Its sharp line of separation; uniformity of products; ease of adjustment to produce different products; automatic response to varying loads of sand; lack of response to varying loads of sand; lack of response to varying loads of water; lack of attention required from operators; simplicity and durability of wearing parts; lack of power requirements; accessibility and ease of replacing worn parts; simple, compact and semi-rigid construction, and careful design and accurate workmanship.

Recently the Premier, Beaver, Big Elk, Vantage, Woodchuck and Empire Development companies in the Joplin-Miami zinc-lead district have installed one or more of these classifiers. The inventor is Charles E. Wood, mining engineer, of Baxter Springs, Kan.

CONSTRUCTION NEWS

Arizona Standard Copper Co. Builds Leaching Plant

Progress is reported in assembling the machinery for a 300-ton leaching plant on the property of the Arizona Standard Copper Co., fourteen miles east of Parker, Ariz. It is claimed that on the property has been developed 20,000,000 tons of 3 per cent carbonate or oxide ore. Precipitation at first is to be on scrap iron, with plans made for electrolytic vats, as at Ajo. On the ground now are the power plant, crusher, and ball mill. The company was founded by T. J. Carrigan, now deceased. His son, W. E. Carrigan, is manager. Among the directors of the Standard Copper Co. are S. S. Wold, who is president of the Tom Reed Gold Mining Co.

Joplin District Will Have New 350-Ton Concentrator

The Interstate Zinc-Lead Corporation is preparing to erect a 350-ton concentrator on its lease near Crestline, Kan., about fourteen miles northwest of Joplin, Mo. It has purchased the Red Rose mill, in the Picher region, and will use most of the material from it. Actual construction will begin soon. A. M. Gaines, of Picher, Okla., is general manager.

Silver Crown Planning Small Mill

The Silver Crown Mining Co., whose property is in the Lardeau district, British Columbia, near Trout Lake, is planning a 60-ton mill on the Foggy Day group, which is near the Silver Cup mine. Trial shipments which the company has made to the Trail smelter have shown returns of $82 per ton in gold.

Chief Consolidated Planning Improvements at No. 1 Shaft

The Chief Consolidated Mining Co., Eureka, Utah, is planning improvements at its No. 1 shaft whereby a large tonnage can be more rapidly and economically handled at the surface. The head frame will be carried up about 24 ft. and a rotary tipple installed for unloading the mine cars. Under the new system, mine cars carrying waste, upon arrival at the surface, will be emptied into a large car of 6-ton capacity and immediately released, whereas at present there are always a large number of the cars on the surface. The collar of the shaft will be raised a few feet and trackage so arranged that the mine cars loaded with ore will run by gravity to the bins where rapid dumping apparatus will be installed. The cars will return to the shaft on an inclined track and will be lifted to the loading point for the cage by an especially constructed elevator.

Seneca Copper Co. Is Constructing New Surface Plant at Gratiot Shaft

The Seneca Copper Co., whose property is near Mohawk, Mich., is drifting north from the thirteenth level, Gratiot No. 2 shaft. It also has the intention to drift south at the eleventh level. The ground between these two levels was unusually rich in a raise from the thirteenth. Good progress is being made with construction of the surface plant at the Gratiot shaft. The new hoist is being assembled and the installation of the new compressor will start soon. Three miles of railroad to connect with the Mineral Range line will be built this summer.

Hanna Ore Co. to Erect Buildings at Buhl, Minn.

The M. A. Hanna Ore Co., Hibbing, Minn., is clearing a tract of land on the outskirts of the village of Buhl, Minn., to erect shop buildings to serve the Wabigon No. 1 open pit. The shops are to be for general repair work, including a machine, blacksmith, carpenter shop and a warehouse. The building program further includes a coal dock and water tank to serve the engines for the pit and four dwellings which are to be built for the use of employees.

Selkirk Mining Co. Reported to Be Building Mill

Frank Phillips, superintendent of the Selkirk Mining Co., at Rice Lake, near Lake Winnipeg, Manitoba, has been visiting British Columbia to obtain a number of practical miners for work on this property. The Selkirk mine, he says, is being actively developed and a new mill is under construction. Work is being done on a large new body of milling ore, which will average about $14 a ton.